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109 rejected for physical incapacity,—viz., 24 for cutaneous and highly-infectious diseases, 6 for phthisis, 32 for diseases of the eye, 4 for habitual convulsions, 2 for typhus fever, 1 for scarlet fever, and 18 for scrofula. Now, let us imagine for a moment that there was no such thing as inspection by authority, and the juvenile labour-market would be restored to the state it was in at the time when the great outcry existed against the millocracy, as the authors of the misery and wretchedness which was but too apparent amongst the factory workers. Under such circumstances, not only would all those who caught at the factory the infectious diseases, brought there through the cupidity of the parents of the poor suffering children, be deemed the victims of the vicious system of factory labor, but those children, also, who possessed the seeds of the several ailments above mentioned, before they saw the inside of a factory. That a large amount of misery arose from this cause, there can be no doubt, which was considerably aggravated by the ignorance which, until very lately, prevailed respecting the hygeian principles of cleanliness and ventilation; but that factory labor was ever more physically deteriorating than kindred home industry, we think there is every reason to doubt. Uncongenial it certainly is, to some minds, as the biographical sketch of the author of "Babe Christabel" proves; but, among the thousands of children who trudge to their labor with no brighter earthly hope before them than uninterrupted occupation, with wages increasing until the maximum is attained within the next ten or fifteen years of their life, how few must there be who ever experienced the same feeling of revolt at the nature of their employment as the incipient poet, Gerald Massey? The sketcher of his early life tells us, that "at eight years of age, Gerald Massey went into a silk-mill, rising at five in the morning, and toiling there till half-past six in the evening; up in the grey dawn, or in the winter before daylight, and trudging to the factory, through the wind and snow; seeing the sun through the factory windows; breathing an atmosphere laden with rank oily vapours, his ears deafened by the roar of incessant wheels; then home, shivering under the cold, starless sky, on Saturday nights, with 9*d.*, 1*s.*, or 1*s.* 3*d.* for his whole week's work,—for such were the respective amounts of the wages earned by the child-labor of Gerald Massey." It is no wonder that a child so sensitive to outward circumstances as to be able to record, that "Ever since I can remember, I have had the aching fear of want throbbing in heart and brow," should, when the mill was burned down, have rejoiced in the conflagration. But then, as compared with his factory labor, what advantages had the domestic manufacture, to which his time was subsequently devoted, to offer? None, if we are to take the sequel of the narrative; for his biographer continues:—"Then he went to straw-plaiting,—as toilsome

and, perhaps, more unwholesome than factory work. Without exercise in a marshy district, the plaiters were constantly having racking attacks of ague. The boy had the disease for three years, ending with tertian ague. Sometimes four of the family, and the mother, lay ill at one time, all crying with thirst, with no one to give them drink, and each too weak to help the other." Here, then, is no very enviable picture in favor of home labor, as contrasted with factory work.

Of the great physical superiority of the workpeople of the present day over those of the past, the reports of the Factory Inspectors afford indubitable evidence; and they are by no means silent with respect to the causes which will account for the manifest improvement in their physical condition. Thus, in speaking of a large cotton factory in his district, Mr. Alexander Redgrave says:—"I am always struck with the cleanliness and order which are everywhere visible; the rooms, which must be necessarily warm, are, nevertheless, so well ventilated that the heat is never oppressive;" and he further states, that in those departments of the establishment where a large quantity of dust and fly is scattered, as in the carding-rooms, the best means is provided for purifying those rooms. Although these remarks refer to a model establishment, its superiority evidently consists in the degree to which cleanliness, order, and ventilation are carried, and not by contrast with others where these essentials are wholly neglected. Mr. Baker, also, in speaking of the improved appearance of the workpeople, as compared with past years—a matter on which a professional education had qualified him for giving judgment—attributes it to the working of the Factory Acts, by which the hours of labor have been diminished. At a bygone period, he says (previous to 1833), the "factory leg" and the "curved spine" were a proverb and a reproach everywhere in the factory districts of Lancashire and Yorkshire; and that, "as a general rule, there was an abnegation of the duties and sympathies which should ever exist between master and servant." But now, he says, the proverb has died a natural death. "There is scarcely to be seen, in any of the manufacturing districts, a crooked leg or a distorted spine, as the result of factory labour; unless, indeed, it be an old man, one of the specimens of other days. The once pale and haggard faces are now ruddy and joyous; the once angular forms are now full and rounded; there is mirth in the step and happiness in the countenance." Furthermore, his report says, and we quote it with unfeigned pleasure, as incontrovertible evidence of the march of social improvement, *pari passu* with the increase of our manufacturing prosperity:—"In 1833, there were at least 200,000 females employed within the factories of the United Kingdom. 'They were,' says Mr. Smith, the eminent surgeon, of Leeds, writing on this subject in August last, 'a poor, emaciated, and

downhearted-looking race, with angular shoulders and stooping heads, and altogether destitute of the rounded form of healthy women.' There are now 400,000, and they are 'fair and florid, stout and muscular, cheerful and happy, and all the outlines are admirable.' Such is the concurrent testimony of nine of the certifying surgeons, who certify for mills which employ 70,000 persons in the various branches of textile labor, of whom 40,000 are women and children." With all this improvement, much, however, remains to be done; for we find in the Inspectors' returns, under the head of "Accidents arising from machinery," for the year ending 31st October, 1859, no less than 3939 accidents, of which 64 ended in death. The greater portion, if not the whole of these—consisting of amputations of hands, arms, and feet, fractures of bones, lacerations, and contusions—are remediable; for machinery is the most obedient of all servants, and the most certainly to be depended on, as it is subject neither to frights nor fits of temper. Carelessness is, undoubtedly, the origin of these numerous injuries to the person,—carelessness, to a certain degree, on the part of those mill-owners who have neglected to fence their live spindles, pulleys, and belts sufficiently to provide against the possibility of accidents; and carelessness, to a much greater degree, on the part of the workpeople, in tending, adjusting, or approaching the machinery while in motion. More stringent rules would cure the one, but education alone can modify the other.

With respect to that important element in the social well-being of every class of society—education—in its relation to the factory workers, the reports for the past year afford some interesting information. By the Factory Acts, it is provided that those children whose hours of labor are, by reason of their tender age, limited to half-time, shall receive education during their connection with the factory; but there is no further compulsion put on the parents to send their children to school when their remunerative employment ceases. Consequently, the result of the partial education which these factory children receive is most unsatisfactory. Mr. Leonard Horner, the most experienced of the Factory Inspectors, declares the education of the children, in numerous cases, to be "an utter mockery." Sir John Kincaid, the Inspector for Scotland, says:—"Children who are required by law to receive instruction while employed in factories, continue to have every justice done them; but there is no sensible increase in the number of children so employed, nor, I fear, is there likely to be, in my district." Mr. Baker says, out of 2500 young persons, between the ages of 13 and 16, examined on offering themselves for employment in factories, within the districts of seven certifying surgeons, upwards of 42 per cent. could not read at all. Mr. Redgrave gives, as the result of his

experience, a confirmation of the deplorable insufficiency of the present system of education. He requested Mr. Chorley, the certifying surgeon for Leeds, while examining the candidates for full-time certificates, to distinguish those children who had been previously employed as half-timers, with the view of ascertaining the progress made under the half-time system of education. From the 1st April to the 31st October last, Mr. Chorley certified 499 young persons, of whom only 123, or 24 per cent., could read. Of the 376 who could not read, 89 had been employed for half-time in factories, and attended school, between the ages of 8 and 13 years, for periods extending, in some instances, to an aggregate of three years. As a remedy for this non-education system, Mr. Baker suggests the enactment of a law providing for a prospective educational test, to come into force five years hence; certificates of fitness to work being withheld from all candidates who had not passed the test; and Mr. Redgrave evidently approves the suggestion, for he says:—"The experience which accumulates from year to year convinces me that the principal object to be attained is the attendance of children at school *before* they are employed." Something of this kind is already being carried out by mill-owners, for Sir John Kincaid says:—"The adoption of an educational test continues to advance in practice, and now includes the extensive factory of Messrs. Alexander, in Duke-street, Glasgow." But it is obvious that this course cannot be carried out extensively without the aid of Parliament. That there would be no serious difficulty in enforcing education as proposed, is proved by Mr. Baker, who says:—"My request to the surgeons to examine the reading capabilities of the young persons who were candidates for employment, led to an impulsive rush to school in those neighbourhoods, under an impression that in future none would be employed but those who could read and write."

As the social condition of the factory workers is intimately connected with their intellectual advancement, it is evident that, when education is at so low an ebb as we have seen, the home life of this class does not present so bright a picture as might be desired. Of domestic economy the wives know as little as the men of political economy, for they have not learned to think. Although, therefore, work may be plentiful, and wages good, the men will, not unfrequently, under a fallacious hope of securing immediate advantages, set about actively to create an artificial stagnation of business, whereby the supplies for the sustenance of their households will be cut off; while the women, by a course of ignorant extravagance, are doing their best to dissipate the funds entrusted to their management. Discontented with their lot, workmen will provoke a quarrel with their masters, and fight them without weapons, trusting to the reckless statements of interested agitators, and unheeding, because

unable to appreciate, such advice, as Mr. Baker gives, to the effect that a good balance at the savings' bank is the best guarantee of justice being rendered to the workman, and that the opportunity is open to every man in the industrial districts to save, between his eighteenth and twentieth year, from £70 to £80, allowing both for sickness and bad times. Of strikes, he says:—"The supreme folly of a strike is shown by the fact that there is seldom or never a rich workman at the head of it." And he further remarks, that, "supposing the reason for it to be ever so feasible and just, there is no weapon which can be so safely used against tyranny of any kind, whether real or imaginary, *as that which can be drawn at any moment, with a fortnight's notice.*" As the working classes have now learned that machine-breaking and rick-burning do not conduce to their prosperity, so we may hope that, at a period not far distant, they will have advanced another step in political economy, and learned that to paralyze trade is not exactly the best way to improve their own condition. Our faith in the good intentions and sense of justice of this, in many respects, worthy class of the community, is strong; and, therefore, we are confident that trade combinations will ultimately be revolting to the industrious workman; but the change will certainly be slow. As respects the improvement of their household arrangements, we see the germ of that already. For, to quote once more Mr. Baker's reports, "great interest is now taken by the ladies of some of the large towns in which there are factories, in the social and mental improvement of the female workers. . . . This interest—*i.e.*, the sitting with, addressing, and instructing the women of our workshops, once or twice a week, all the year round—is destined, I think, to effect a greater revolution in the habits of the people, than all that educational institutes could do without it; because, when home economy begins, home attractions follow, and then home blessings begin to tread upon the drunkenness, vice, and immorality which arise out of a state of operative wealth, so to speak, which knows no better employment than sensual gratification, and which sees no necessity for self-control."

To men like the present Factory Inspectors, who evidently have the welfare of the factory workers at heart, it would be safe to entrust enlarged powers. Already they ask for power to enforce more thorough fencing of machinery, and to establish the educational test; but, further than this, they might beneficially exercise the right of establishing regulations respecting the dress of female workers, both for the sake of health and safety of life and limb,—crinoline, for example, being now frequently seen in dangerous proximity to machinery; and they might also apply, with advantage, a portion of the funds in their hands—derived from fines levied on the evaders of the Factory Acts—to the instruction of females in the various branches of domestic industry.

As the carrying out of these suggestions would have the appearance of coercion, they should, if adopted at all, take precedence of the long-promised Reform Bill, which, by greatly extending the political power of the laboring classes, is eminently calculated to check the passing of all coercive measures directed to improve their condition.

RECENT PATENTS.

To SIR JAMES MURRAY, *of Dublin, for improvements in the preparation and bottling or preserving of carbonated cod-liver oil, and other aerated liqudis.*—[Dated 24th August, 1859.]

THIS invention has for its object the improvement of the medicinal and other qualities of carbonated cod-liver oil, and other carbonates or bi-carbonated mixtures, such as solutions of lime, magnesia, camphor, and other such solutions and waters in ordinary use. It is well known that these liquids, as ordinarily prepared, are liable to become impaired by exposure to the air and by evaporation during the process of filtering and decanting or fining.

Now the invention consists, in the first place, in re-carbonating the previously carbonated liquids after they are purified; and for this purpose the patentee takes the carbonated liquids, prepared in the ordinary manner, and fined ready for bottling, and impregnates them with a strong additional charge of fixed air; he thus takes any of the ordinary aerated liquids, such as the ordinary solution of magnesia, and makes that the basis on which the new re-carbonating process is worked. The invention comes into operation at the stage at which the manufacture has hitherto ended; the apparatus used for the purpose may be such as is ordinarily used in the original process, so long as it is capable of bearing a pressure of several atmospheres; a pressure of about two hundred pounds on the square inch is preferred when the re-aerated fluid is at once bottled from the engine, and not set aside to settle as hitherto.

The invention consists, in the second place, in preparing the vessels required to contain the said recarbonated liquids, so as to make them cleaner and more fit to preserve the same. For this purpose, the vessels are prepared by expelling from them the common atmospheric air which is displaced by an atmosphere of carbonic acid gas, supplied by pumps.

The invention consists, in the third place, in forcing the liquids into the bottles while they are immersed in the gas contained in the said vessels. By this means, the liquor meets the same gas in the bottles as that which is already in the re-carbonated liquor or liquors.

And the invention consists, lastly, in displacing common air and other ordinary vapours, gases, or impurities, from the pores of the corks. This is effected by keeping them some days immersed in carbonic acid gas, or by confining them in an air-tight vessel, and withdrawing the common air from them by means of an ordinary air-pump. When a sufficient vacuum has been attained, some of the same liquor about to be bottled is

admitted to the corks, and is made to penetrate them, and pass into the pores thereof, which thus become saturated with the liquid intended to be preserved. By the means above described, the liquid entering the bottles does not come in contact with the common air in the bottle, as in the ordinary mode of bottling, and the interval between the surface of the liquid in the bottle and the cork is filled with a powerful antiseptic air or gas. It will thus be evident, that by the use of the invention the ordinary tendency of the aerated liquids to become vapid, bitter, and occasionally turbid, will be obviated, and that they will be preserved in a fresh and sparkling condition. By displacing the atmospheric air with its vapours, smells, and miasma, and filling the bottles with fixed air instead, and by bottling under a pressure of that gas, aerated liquors are freed from the contact of vapours and foul air of towns. By excluding the common air, the decomposing power of its oxygen is prevented. When the bottles are previously charged with carbonic acid gas, the liquors entering into them meet with an air of the same kind as that already contained therein, whilst, on the contrary, if flowing into bottles through common air, subject to all kinds of vitiation, the contaminations remain in the liquors while the atmospheric air is discharged. Corks also are liable to imbibe the breath, foul air, and smells, in crowded places and works. By withdrawing this air, and causing carbonic acid, or some of the liquor about to be preserved, to enter into them, the fault called "corking" is abated or prevented, together with the contact of all hurtful emanations.

The invention is also applicable to the better preservation of ales, porter, and other fermented liquors; also to animal or vegetable food and medicinal infusions. On the same principle, holds of ships, closets, cellars, hospital wards and beds, drains, and low infected places, can be deodorized and ventilated by filling them with antiseptic fixed air, until vermin, foul odours, and miasms are driven off or abated. Carbonic acid gas is also useful for excluding oxygen during surgical operations; the lower part of the body or one of the limbs being supported in a wide vessel containing that gas, due provision being made for respiration. Anatomical subjects or preparations can likewise be kept more safely in this antiseptic gas.

The patentee claims, "First,—the revivifying of the aerated liquids after having been already prepared in the ordinary manner, by repeating the process or processes of aeration after the liquids have been fined, and just before they are bottled, under such pressure as to secure an excess of fixed air, in order to preserve them in better condition than those hitherto in ordinary use. Secondly,—the preparation of the bottles, by displacing them from the ordinary atmospheric air with any impure vapours, miasma, or gases therein contained, and replacing it by an atmosphere of carbonic acid gas. Thirdly,—the bottling of the liquids in vessels containing an atmosphere of carbonic acid gas, that being the gas already in the re-carbonated liquor or liquors. And, lastly, the preparation of the corks, by withdrawing from them the ordinary atmospheric air, with its impure vapours or gases, and causing some of the liquors intended to be bottled to enter their pores and saturate them.

To John Henry Johnson, *of Lincoln's-inn-fields, for improvements in reducing solid substances to powder, and in the machinery or apparatus employed therein,—being a communication.*—[Dated 3rd June, 1859.]

This invention relates to a mode of reducing to powder certain substances, which, on account of their peculiar nature and consistency, cannot be effectually operated upon by ordinary grinding apparatus; and relates, also, to a peculiar construction and arrangement of machinery for accomplishing such reduction.

In Plate I., fig. 1, represents a longitudinal vertical section of a reducing machine, constructed according to this invention; and fig. 2, is a plan corresponding to fig. 1. A, is an ordinary circular saw, secured to the spindle B, which turns in suitable bearings a, a^1, fitted to the opposite edges of the table or platform C, which is supported by, and secured to, any suitable frame or pair of standards D. On each edge of the platform is fitted a raised guide-rail e, e, between which guides is fitted, to slide freely, the box or frame E; its movement being in a line or parallel with the plane of the saw, without having any lateral play. A slot f, is cut transversely in the box E, and this slot coincides with another one in the platform, within which the saw revolves freely. To strengthen the box, two curved ribs h, h^1, are secured to the back thereof. A longitudinal slot is made in the back of the box, to admit the ends i, of the two slides G, G, which slides fit into the box, and are moved along therein by the screw-spindle H, which works through the ends i, of the slides, and turns in bearings m, m, secured to the opposite ends of the box. One half of this screw-spindle is formed with a right-hand thread, and the other half with a left-hand thread. On turning, therefore, the screw-spindle in one direction, the slides G, will approach each other simultaneously; and on turning it in an opposite direction, they will simultaneously recede from each other.

The materials to the reduction of which this invention relates, are either of such a glutinous, fibrous, or, in other respects, tough nature, as to prohibit the use of ordinary grinding mills. Amongst such substances may be classed the animal matter forming the residuum after the process of boiling tallow, and which is generally compressed into cakes, in which state it is known in the trade as "graves" or "crackling." The powder of this substance is extremely valuable for farm purposes, both as a manure, and as food for live stock.

This invention is equally applicable to the reduction of gutta-percha, or of scraps of leather, temporarily cemented together into masses or blocks, and also to the reduction of dye woods.

The following is the mode of reducing substances in this apparatus:—The slides G, G, having been moved to the two opposite ends of the box, by turning the screw-spindle H, the block of material to be reduced is placed within the box, and the screw is then turned until the block is confined between the two opposite slides G. The box E, with its appendages, is now pushed forward, by hand or otherwise, and the block is severed by the saw; after which the box is drawn back clear of the cutter; the screw H, is again turned to an extent sufficient to bring the severed ends of the block into close contact with each other, and the box is again pushed forward, and the material acted upon by the saw, as before, but in the exact line of junction of the two halves of the block: this is continued

until the whole of the block has been reduced by the teeth of the saw, the resulting powder or sawdust passing down a shute I, to the ground, or into a suitable receptacle to receive it. It will be observed that, when the severed ends of the block are brought together after each cut, the point of contact must invariably be in a line midway between, and parallel to, the sides or edges of the saw. Not only, therefore, does the latter act as though cutting through an undivided block, but each severed half of the block furnishes its separate quota of powder removed by the saw.

The patentee claims, "First,—the general construction, arrangement, and combination of machinery or apparatus for reducing solid substances to powder, as hereinbefore described. Second,—the system or mode of reducing glutinous, fibrous, and other tough materials to powder, by placing the ends of blocks of such material opposite to, and in contact with, each other, and presenting them simultaneously, and at the point of junction, to the edge of a rotatory or reciprocating saw or other suitable cutter, as hereinbefore described."

To ZACCHEUS NUTTALL, *of Stockport, for improvements in looms for weaving.*—[Dated 12th October, 1859.]

THIS invention consists in an improved combination of machinery for raising and lowering the healds to form the shed.

In Plate I., fig. 1, is a sectional elevation of the improved machinery. *a, a,* are two frames, bolted to the upper part of the framing of the loom: the bolt *b,* connects the two frames *a, a,* and supports the top jacks *c*; the top jacks *c,* are connected to bottom jacks, and the healds are connected to the jacks in the usual manner. At each end of the jacks *c,* are loops for the shot-bolts d, d^1, to slide in; these shot-bolts are connected by the wires e, e^1, and centre-piece *f.* The pattern chain *g,* is constructed with pegs or pins in the usual manner, and passes over the drum *h,* which is supported in bearings attached to the frames *a, a*: the pattern chain *g,* passes over the guide-roller *i,* supported by rack-bars *j.* The pins on the chain *g,* act on the spring wires *o, o,* which are attached above to the cross-piece a^2, and, after passing through the guide-plate a^3, enter into the centre-pieces *f*; the frames *a, a,* are also connected by the stays k, k^1, the projecting ends of which serve as fulcra for the toothed segment levers l, l^1. To the outer ends of the levers l, l^1, are fixed the slot-pieces m, m^1, between which the knives or grifes n, n^1, are supported; these knives are also guided in the segmental slots a^1, a^1, in the frames *a, a.* Each pair of levers l, l^1, and the knives n, n^1, form a swing frame. The levers l, l^1, are connected by the pieces p, p^1, to which the buffers q, q^1, are attached. To one of the levers l^1, is jointed the catch *r,* by which the drum *h,* is turned partly round after each shed has been made; the drum being held in position by the spring-lever *s,* and notched-wheel g^1, seen best in fig. 2. The mode of operation is as follows:—The dotted lines in fig. 1, represent the jacks *c,* horizontal, or in the position they assume when the shed is closed; the shot-bolts d, d^1, being brought towards the right-hand end of the machine by the spring-wires *o,* during the closing of the shed. As soon as the drum *h,* has been moved so as to bring forward another link of the chain *g,* the pins on the link thus brought forward,

which are placed according to the pattern required, acting on the wires *o*, push the shot-bolts of the jacks that are selected in the direction of the arrow, thereby bringing the shot-bolts *d*, under the knife *n*, while the shot-bolts d^1, of the jacks that are not selected, remain under the knife n^1; consequently, when the levers *l*, l^1, are drawn down by a crank on the crank or other shaft of the loom in the usual manner, the knife *n*, depresses the jacks that are required to form the lower part of the shed, and the knife n^1, depresses the others.

The patentee claims, "the application of shot-bolts to jacks or levers, in combination with suitable machinery for moving them into position for being depressed by the swing frames, as shown and described, or any modification of the same."

To ROBERT SMITH, *of Longridge, near Preston, for improvements in apparatus applicable to looms for weaving fancy fabrics.*—[Dated 22nd June, 1859.]

THE object of this invention is to place between the warps, at the opening of the shed, a cord or thread, in a zig-zag or vandyke position, which, when beaten up, will form a fancy fabric.

The manner of carrying out this invention is shown in Plate I., where fig. 2, is an end elevation of an ordinary hand loom, fitted with apparatus for laying the cord in the shed, and figs. 2, 3, 4, 5, 6, 7, and 8, are detached views of some of the working parts and modifications thereof. *a*, represents the framework of the loom; *b*, the yarn beam; *c*, the cloth beam; *d*, the healds; *e*, the warp; and *f*, the batten or lathe. Below the warp are the pins *g*, for placing a cord or thread, passed between the open shed, in a zig-zag or vandyke position, as seen in fig. 4. The said pins are attached to the bars *h*, which vibrate in the supports *i*, so that they can be vertical, as seen in figs. 1, 2, 4, and 6, and inclined downwards, as seen in figs. 3, and 5; the supports being fixed to the framework of the loom, as seen in fig. 1, or hinged, as in fig. 6, so as to be lowered when not in use, as shown by the dotted lines. Between the supports there is fixed a bar *k*, for the purpose of steadiness. The pins may be raised as required by operating upon the bars by a handle, or by connecting to them pulleys *l*, which are encircled by cords *m*, connected to one or more levers. In fig. 1, the cords *m*, are attached to a lever *n*, which is operated upon by connecting it with another cord *o*, to a lever *p*, working on a pin fixed to the batten. The bars may be moved by placing pulleys on both their ends, and attaching cords from the pulleys to treadles, one at each side of the loom, for the convenience of moving the pins without the necessity of the operative changing his position. In fig. 7, the bars and pins are acted upon by means of compound levers. The bars have pulleys, cords, and an under lever, similar to those in fig 1, but the under lever *n*, is connected at the back by the cord *r*, to an upper lever *s*, which is again connected by the cord *t*, to a lever *u*, working on a pivot on the batten. When the cord or thread between the warp has been placed as desired, and the operative removes his hand from the lever, the pins return to their lowest position, which movement is caused by means of elastic bands *w*, seen in figs. 4, and 5, one end of each being attached to the support, and the other to one of the bars; but a similar

return movement can be obtained, as shown in fig. 8, by causing weights *x*, or springs, to act upon the inner parts of separate pulleys *y*, fixed to the bars *h*.

The patentee claims, "the employment of pins, working below the warp, for placing a cord or thread, passed between the open shed, in a zig-zag or vandyke position; and also the levers, elastic bands, and weights, for giving them motion, as described and illustrated."

To WILLIAM EDWARD NEWTON, *of* 66, *Chancery-lane, for an improved method of making combs or gills employed in the preparation of fibrous substances,—being a communication.*—[Dated 18th October, 1859.]

THE object of this invention is to economise the manufacture of gills or combs, and, at the same time, more effectually to secure the pins or teeth in their seats, so that they shall not work loose. An incidental advantage of this invention is, that when the gills or combs are damaged, they may be repaired at small cost, the undamaged portions being applicable for their re-construction.

The following is the method adopted:—A trough of iron or other suitable hard metal, similar to that shown in plan and end views at figs. 1, Plate I., is first provided, the same being formed either by planing down a solid bar, or otherwise. This trough is to constitute the back of the gill, and it is, therefore, made of any suitable width, according to the number of rows of pins the gill is intended to possess, and also of any convenient length. The trough, shown at figs. 1, is made to receive six rows of pins. For constructing a gill of six rows of pins, three gauge-plates, made by preference of bell-metal, are provided, which plates are grooved on their opposite faces, to form recesses, for the insertion therein of the six rows of pins to be employed in making the gill. To the opposite faces of these bell-metal plates, stop-pieces *b*, *b*, are applied, which extend across the extremities of the grooves, and are intended to gauge the distance that the pins shall enter the grooves. When using these plates, they are clamped together by means of cheeks *c*, *c*, and clamping-screws *d*, *d*; (see fig. 2,) filling-pieces of metal *e*, *e*, being inserted between them, near their upper edges, and filling-pieces of leather or other yielding material *f*, *f*, near their lower edges. Before tightening the lower clamping-screws, the pins are inserted in the grooves, as shown at *g*, *g*, the same being pushed down until their points are arrested by the stops *b*, *b*. The clamp is now tightened up, and the pins are ready for insertion into the metal back, figs. 1. In order to transfer the pins from the clamp to the metal back or trough which is to form the gill-bar, the ends of the trough are temporarily closed, by a strip of tin or otherwise; and easily-fusible metal, or other suitable cementing material, is poured therein, and kept in a molten state, by the application of heat thereto in any convenient way. The charged clamp is now placed over the trough, and the roots of the pins inserted in the molten metal; the inner surfaces of the trough having previously been wetted with, and the roots of the pins dipped into, a solution of muriate or nitro-muriate of zinc, to ensure the adhesion of the molten metal thereto. By withdrawing the heat, or applying water to the side of the trough, the metal will quickly set; and when this has taken

place, the clamping-screws are slackened, when the clamp will come away, leaving the pins firmly fixed in the gill-bar.

In order to repair gills or combs made according to this invention, the bent or injured pins of the gill or comb are first broken off close to the bar, and the clamp used in making such gill or comb is applied to the remaining pins, so as to embrace them, the clamping-screws being slackened for that purpose. When the pins are inserted in their respective grooves, the clamp is tightened up, and the ends of the trough or back of the gill-bar being closed, heat is applied to the gill or comb, to fuse the soft metal. The pins held by the clamp are now withdrawn, and any deficiency of pins in the clamp is made good; they may then be re-inserted in the gill-bar, as before, and the setting of the metal will effectually unite the pins to the bar, and form a strong and solid gill.

The patentee claims, "the manufacture of gills or combs, as above described."

To ADOLPHE LEARCH, *of Brussels, for an improved process of manufacturing embossed sheets or stuffs, called embossed fictitious leather, for hangings and household furnitures,—being a communication.*—[Dated 8th November, 1859.]

THE materials used for manufacturing embossed hangings, according to this process, are of various kinds, depending on the size and nature of the surfaces they are intended to be laid upon,—flat, smooth surfaces, either in mason's work, wood, or cloth. The sheets intended for making the hangings are composed either of a single sheet of paper, of any required shade, or of two or three sheets of paper, united together by means of an adhesive mixture composed of flour, white chalk, glue, and boiled oil; or else of a single sheet of paper covered with cloth. When the upper sheet is not to preserve its primitive shade, it is coated either with the gold varnish used for manufacturing the ancient gilt leather, or with any other varnish imitating the appearance and shade of either stuffs, enamels, or metals to be imitated. The impression of the ground or main parts of the pattern may be made by means of a common printing press, with oil-colors composed of oil varnish, and beeswax; or it may be printed by means of engraved wooden plates and common water-colors,—the most important parts being colored by hand. The raised or embossed surfaces are produced by a common fly-press, and a metallic under-plate, on which the pattern is cut or sunk; then a layer of glueing cement is applied inside of the raised surfaces, to give them the required consistence.

With respect to hangings to be applied over rough surfaces, the way of manufacturing them is the same, except that a layer of cement is applied, not only to fill up the recesses, but also to cover the raised parts with an uniform and plane thickness of about three-eighths of an inch, capable of adhering to the surfaces to be adorned. A coarse cloth or any other stuff, being used for the woof, according to the nature of the surfaces, put sometimes over, or at other times in the middle of the layer, will considerably strengthen it, so as to make it last a number of years. Hangings may be made, by the same process, with either leather, gutta-percha, American leather, or other analogous materials.

For coloring the piece of stuff intended to be embossed, water or oil-

paint, largely diluted with essence of turpentine, may be used. For giving successively all the various colors of the pattern, it is sufficient, at each impression, to dab, with a sponge saturated with water, the back of the cloth, until it has expanded in a sufficient degree to emboss it. The colored impressions are produced by means of carved wooden plates, in the same manner as for common paper-hangings; as is also the glazing.

For printing with oil-colors, typographic rollers are used. The gilding is performed by means of oily size, over which gold leaves are laid, and struck with the palm of the hand, then dusted over with great care. The stuff should have been previously done over twice with suitable glueing composition, necessary to be enabled to varnish after embossing; for if this glueing were done over the gilding, it would be greatly injured. The velveting, either plain or ornamented and gilt, is applied over an oily size; the band or piece of stuff is prepared as is done for coloring it. All being perfectly disposed to correspond with the embossing-stamps of the pattern, the sheets or bands must be stiffened or strengthened, before embossing. The bands or sheets being either colored or velveted, as described, a second band, not colored, but of the same size, is taken, and both ends are coated over with glueing mixture on the under face; and the second sheet is, besides, coated with a mixture composed of white chalk, china clay, colophony, melted together, and bound with soft black soap or salt of tartar;—this coating is intended to maintain the embossing and elasticity of the stuff after the stamping. When uniting the two bands or sheets, thus prepared, care must be taken to leave near the end the colored or velveted side of one of them, and to rub it softly with the hand, so as to give a first adhesion to the said bands or sheets. The bands are now in a suitable state for embossing, which operation is effected either in a Congreve or hydraulic press. After the embossing, there remains two more operations to make,—the stoning or stuffing up of the embossed pattern, and the varnishing. The stuffing up is performed with a large scraping-blade, used to spread into the recesses of the back of the embossed stuffs the glueing mixture previously described. Lastly, the embossed stuff is varnished, after two layers of gelatine glue have been spread over with a sponge; taking great care to rub smoothly with a badger's-hair brush, in order to remove all the little asperities of the layers.

The patentee claims, "First,—the preparation, printing, and coloring sheets or bands of paper to be embossed, as described. Second,—uniting the said sheets with one or several other sheets of the same size, either paper or any other kind of stuff, according to the requirements, by glueing them with a special adhesive composition. Third,—embossing or stamping the said sheets or bands, under suitable presses or apparatus used for such kind of work. Fourth,—stuffing the recesses of the back side with an adhesive mixture, after embossing, and finally varnishing the front side, as set forth in the foregoing description, and obtaining ornamented embossed surfaces, having the appearance of embossed leather."

To JOHN THOMSON, *of Dundee; for improvements in the manufacture or production of Brussels and velvet-pile carpet fabrics and hearth-rugs.*—[Dated 8th November, 1859.]

THIS invention relates to the manufacture of Brussels and velvet-pile carpets and hearth-rugs, entirely or chiefly of jute or jute hemp, in or by the agency of power-looms. The jute or jute hemp for manufacturing the Brussels and velvet-pile fabrics is spun into yarn, dyed, and otherwise prepared for the manufacture, in the same manner as wool or other fibrous material is prepared for weaving. The prepared jute yarn is used in the loom in the same way as the woollen yarn is ordinarily used, to form the surface of the fabric. If the fabric to be woven is of the looped class, as in Brussels carpeting, the jute yarn is woven in over wires, or other loop-forming mechanism; the binding in of these loops, as well as the formation of the cloth at the back, being composed of linen or cotton yarn, or a combination of other suitable fibrous materials. In the manufacture of fabrics having a velvet-pile surface or face, similar to what are known as Wilton carpets, the loops of the jute yarn may be made somewhat deeper than those of the Brussels carpeting, and these loops, as they are formed, are cut through by means of suitable mechanism. The fabric, when completed as far as the weaving operation is concerned, is then passed through a cropping machine, so as to cut off the uneven ends of the cut loops, and reduce the surface to a uniform level or velvet-like pile.

The patentee claims, "First,—the application to, and use in, the manufacture or production of Brussels or looped and velvet-pile fabrics, of jute or jute hemp, as described. Second,—the system or mode of manufacturing or producing fabrics in which the looped or velvet-pile surface or face of the fabric is formed wholly or chiefly of jute or jute hemp, as described."

To HENRY JUSTINIAN NEWCOME, *of Shenley, near Barnet, for an improved apparatus for heating or warming buildings.*—[Dated 30th July, 1859.]

THIS invention is designed to heat or warm buildings more uniformly, speedily, at considerably less cost, and with greater security against accident, than by the means heretofore commonly employed for such purpose.

In Plate I., fig. 1, exhibits, in longitudinal vertical section, one arrangement of the improved apparatus; and fig. 2, is a transverse vertical section, through the line A, B, of fig. 1.

The improved apparatus constituting this invention is composed of the following principal parts:—First, an oven or furnace A, the doors B, of which are in the external wall C, of the building which it is desired to warm. The bottom of this furnace is provided with grate-bars *a*, about four feet long, and the remainder of the bottom is formed closed, with bricks or tiles. The top of the furnace is made of a plate of either cast or wrought-iron, covered with sand, and having two or more openings in the top or sides thereof, for the passage of heat into and through pipes, arranged and combined together in tiers, as follows, that is to say,—immediately above the floor E, of the building, and parallel with the wall thereof, it is proposed to place, one above the other, a series of thin metal

pipes G, G, G^1, of suitable length and diameter. These pipes are connected together, by their ends being secured to thin metal boxes H, in such manner as to admit of the heat from the furnace A, circulating freely through them; the ends of the boxes are made removable, for the purpose of cleansing the pipes when necessary. The ends of the pipes may be connected to the boxes H, by rings of vulcanized india-rubber, where the heat would not destroy the india-rubber. Where the heat is very great, cement may be used. The boxes may be kept tight against the ends of the pipes by tension-rods, or by other convenient and suitable means. The box of the lowermost pipe is connected by an elbow-pipe I, to the top of the furnace; and the uppermost pipe G^1, terminates in an ordinary chimney K. The second or third pipe from the floor is fitted with a damper L, for regulating the intensity of the heat. A second, third, or fourth tier of pipes, arranged as above described, may be connected with the furnace, and brought into action by withdrawing the respective dampers thereof. It is proposed to connect the front end of the furnace with the chimney by a flue M, and damper N, so that, when all the dampers are closed, and that in the chimney is opened, the apparatus ceases to act, notwithstanding the fire in the furnace continues to burn.

By this improved apparatus, a very small quantity of fuel suffices to maintain the desired heat, and by thus exposing a large amount of heating surface, the atmosphere in the building is uniformly heated, and such heat diffused throughout the same, instead of one part of the building being unbearably hot and another part comparatively cold, as is frequently the case at present.

An apparatus constructed on the above principle may be added to any stove or open fire-place now in use, thereby exposing a large amount of heating surface in the building, instead of allowing the heat to escape into the air or chimney. It consists of two or more sets of pipes, terminating in one box, which is divided into compartments by partitions in the interior thereof, which partitions extend across the whole depth of the box, and are closed and effectually separated from each other (except when desired) by the moveable cover at each end; and, by a damper in the upper part of the box being drawn, the apparatus is brought into immediate action, the same movement closing, by a connecting-rod and damper not shown, the flue leading direct from the stove into the chimney. The stove becomes, by this apparatus, of double or treble heating power.

At fig. 1, *b*, *b*, are small pipes connected to each of the horizontal pipes G, for conveying the condensed vapours therefrom; to facilitate which, the said pipes G, should be inclined or lowest at that end where the pipes *b*, are placed.

In adapting an apparatus constructed on the above principle, to heating, warming, and ventilating buildings, it is proposed, in cases where it is desired to heat and ventilate different rooms in a dwelling-house, to carry separate pipes from the furnace (which should be placed at the lowermost part of the building) to each room, and, by dampers, to direct the heat to any particular room or rooms in the house. It is also proposed to construct a vessel around or upon the furnace, to contain water, the steam from which may be conveyed by pipes, fitted with cocks, to any or all of the rooms separately, so as to moisten the air therein, when necessary, or for other purposes. The apparatus may also be mounted on wheels, to allow of its easy transport from place to place.

To JOHN HENRY JOHNSON, *of Lincoln's-inn-fields, for an improved signal light, and in apparatus employed in the production thereof,—being a communication.*—[Dated 8th August, 1859.]

THIS invention relates to the production of a new signal light, capable of being used at sea, as a signal of distress, and applicable in all cases where a powerful signal light is required, such as on railways or in lighthouses, or generally on land, and everywhere where a signal, order, or communication might be required.

In carrying out this invention, it is proposed to apply the spontaneous combustible properties of phosphuretted hydrogen to the production of signal lights, for which purpose any phosphuret is applicable, but more particularly the phosphuret of calcium and the phosphuret of barium. The phosphuret is enclosed in a hermetically-sealed vessel or chamber, so constructed as to admit of the introduction or entrance of water therein, when the gas is required to be generated.

Fig. 1, Plate I., is a vertical section of the simplest form of apparatus to be used at sea, and adapted to life-buoys. A, is a cylindrical metal box, the interior of which is enamelled, in order to prevent the contact of the phosphuret B, with the metal. A mouthpiece C, is formed on the cover D, which is soldered on to the cylinder after the phosphuret has been introduced. E, is a lead or other soft metal diaphragm, soldered on to the neck of the cylinder. Through this diaphragm is passed a wire F, the inner end of which is connected with a cock G, in the neck of the cylinder, provided with a sharp circular cutting edge or perforator, on its upper surface, so that, on the wire (which is connected by a cord H, to the ship) being suddenly withdrawn, by the casting overboard of the apparatus, the cock will be pulled out, and the cutter will puncture a hole in the soft metal diaphragm, and allow the water to enter freely into the interior of the cylinder, during its momentary immersion, and, by mingling with the phosphuret, produce the flame desired, which will continue to burn with an intense light from the mouth of the cylinder, until the whole of the phosphuret is decomposed. In order to prevent the phosphuret from becoming accidentally displaced or shaken, it is proposed to insert a wire-gauze diaphragm I, above it, inside the cylinder. It is intended to use this apparatus in connection with any suitable life-buoy or float, so that, after the first plunge, on being cast into the water, it will float on the surface, and serve as a beacon, signal of distress, or otherwise.

Fig. 2, represents a vertical section of another form of apparatus adapted to be used with the ordinary life-buoys of the royal navy. In this case, a tube K, is passed through the top and bottom of the cylinder A, and projects sufficiently below the bottom of the cylinder to project through the barrel or hollow light supporting stanchion of the buoy—the cylinder itself resting upon the top end of the stanchion, at a slight elevation above the water. The tube K, is perforated with numerous holes, at that part within the cylinder, and is closed at the top and bottom by a lead diaphragm E, through which a wire F, passes. The bottom end of this wire has a small knob *f*, formed upon it, whilst its upper end is connected by a cord H, with the ship. The apparatus, which is fixed to the buoy on being cast overboard, causes the cord H, to be pulled, and the wire F, to be withdrawn. An aperture is thus left in each of the lead diaphragms, and, as the latter is some distance below the surface, the water, by the

constant oscillation of the float and apparatus, rises up the tube K, and passes through the lateral perforations into and among the phosphuret contained in the cylinder. The inflammable gas thereby produced escapes at the upper end of the tube K, where it burns with a bright flame, in spite of wind or water.

Fig. 3, shows, in vertical section, a smaller apparatus, suitable for use either at sea, when hoisted at the mast-head or yards of a ship, or as a signal or beacon on land, when placed in any elevated position. This instrument has an additional or lower chamber L, containing water, which is introduced therein by the lateral pipe and mouthpiece *l*. The lower end of the tube K, dips into the water in the chamber L, and, when the wire F, is withdrawn, the water rises up the tube K, and enters among the phosphuret B, in the upper chamber A, through the lateral openings made in the tube K. Phosphuretted hydrogen gas, escaping by the upper end of the tube K, ignites spontaneously, and burns with a bright and powerful flame.

Fig. 4, represents, in vertical section, a modified form of apparatus to be used for railway or other signals, both on land and at sea, where a powerful and inextinguishable light, under control, is required. The vessel A, is of a spherical form, and above it is placed a water chamber L, which communicates, by means of the pipe and stop-cock M, with the vessel A, below, containing the phosphuret. A second pipe and stop-cock N, connect the upper portion of the chamber vessel A, with a tube K, which passes through the water-chamber or vessel L, and serves as the burner for the gas. *l*, is the nozzle or mouthpiece through which the water is introduced into the chamber L; and *b*, is a similar but larger mouth, made in the vessel A, for the introduction of the phosphuret, both apertures being closed by screwed plugs. *c*, *c*, are feet, which may be cast upon the vessel A, so as to form a support for the apparatus. The size of the burner (which may be either moveable or fixed) is regulated according to the size of the flame-jet required. The respective vessels A, and L, having been charged with phosphuret and with water, as shown (the cocks M, and N, being first closed), the apparatus is ready for use. When required to be put into operation, the cocks M, and N, are opened, and a supply of water is thereby allowed to enter the vessel A, and mingle with the phosphuret. The resulting phosphuretted hydrogen gas escapes through the cock N, into and out of the burner K, and becomes spontaneously ignited on coming in contact with the atmosphere. The gas-cock N, may be kept shut, if desired, so as to confine the gas until required for use, when, by opening it, an instantaneous light is obtained.

Fig. 5, represents, in vertical section, an arrangement adapted for use as a submarine lamp. In this apparatus, the nozzle of the tube or burner K, is surrounded by a concentric pipe O, which extends slightly above the end of the burner. This concentric pipe is connected by a branch P, with a flexible pipe Q, leading to an air-pump at the surface. The object of this addition is to supply the atmospheric air, indispensable for combustion under water, to the light, by forcing air down the pipe Q, which air is brought in contact with the light by means of the concentric tube O, surrounding the burner.

Fig. 6, represents, in vertical section, another modification of this apparatus, constructed in the form of a hollow shot or shell. A^1, is the body of the shell, composed of two halves, screwed together tightly at *d*, *d*,

and provided with a central division-piece R, which divides the internal cavity into two compartments A, and S. In the chamber A, is fitted a metal receptacle *a, a,* for containing the phosphuret, the mouth of which is covered by the wire-gauze diaphragm I, to prevent the phosphuret from being shaken out. A metal mouth-piece C, is screwed into the top of the chamber A, and a disc of lead E, is soldered thereon. Through this disc, a wire F, passes, and enters a cock or stopper G, into which it is firmly secured; its outer end is connected to a string. The lower chamber S, is made air and water-tight, for giving buoyancy to the shell, and it is weighted by a plate of metal *m,* inserted into the bottom, to ensure the shell floating with its mouth upwards. This shell may be used as an alarm in case of fog, or as a signal in war, or as a powerful light for illuminating the coast, and exposing an enemy's fleet. It is intended to be fired from a gun or mortar; the act of firing withdrawing the wire, by means of the cord, which should be secured to the gun, or other convenient fixed point, so that, when the shell drops into the sea, the water will enter the chamber A, and mix with the phosphuret contained therein. The gas then generates, and burns at the mouth-piece C, whilst the shell floats on the surface of the water. This shell may also be made to convey documents, letters, or despatches, which may be inserted by the opening *s,* into the air-chamber, and tightly corked up again before firing. In cases of distress, the fate or situation of a ship may thus be readily made known to any ship in the neighbourhood, which would be instantly attracted by the intense light of the burning shell.

The patentee claims, "First,—the general constructions and arrangements of apparatus for producing signal lights, as hereinbefore described. Second,—the application and use of phosphuretted hydrogen gas, for the production of signal lights at sea or on land, as hereinbefore described."

To JAMES RAWLINGS, *of Carlton-hill East, for an improved construction of boot-tree.*—[Dated 4th October, 1859.]

THIS invention relates to a novel construction of boot-tree, which offers the facility of contracting instantly to receive a boot or shoe, and of expanding to hold the same at tension, and being capable of attachment to any convenient fixed point, will enable a boot cleaner, when using it, to operate simultaneously with both hands on a boot or shoe, and thereby greatly expedite the cleaning of the same.

In Plate II., fig. 1, shows in side elevation a boot-tree constructed according to this invention, suitable for holding a Wellington or other boot during the cleaning operation; the tree being capable of instant contraction to receive the boot, and then of as rapid expansion to retain the boot securely in position while the brushing, blacking, and polishing of the boot is proceeding.

The boot-tree consists of a bracket-piece *a,* of cast iron, the lower extremity of which is intended to enter the boot, and form an abutment for the heel thereof. Hinged to a lug cast on the front of the fixed bracket-piece is a rock lever *b,* also of cast iron, which lever is furnished at its upper extremity with a handle for rocking it, and at its lower end is shaped to fit the toe of the boot or shoe. Affixed to and projecting from the back of this hand lever is a segment rack *c,* formed with ratchet-

teeth on its upper edge. This rack works in a slot formed for it in the bracket-piece *a*, and it is intended to receive a click *d*, which is secured by a pin to the bracket-piece, and is operated by a handle forming a part of the click. The hand lever *b*, is slotted at the foot to receive a tang *e*, attached to a shield *f*, which shield is made of sheet iron, and curved somewhat like the front of the leg of a boot. The construction of this shield is shown best in the detached view, fig. 2, which is a plan view of the shield and its attachments. Secured to the upper end of the shield *f*, and projecting from the inner face thereof, is a segment rack *g*, formed with ratchet-teeth, which rack, when the shield is fitted in its place, passes through a slot made for it in the hand lever *b*, and through a second slot in the bracket-piece *a*. Hinged to the hand lever is a click *h*, which takes into the teeth of the segment rack *g*, and serves to hold the shield securely in the required position for extending the leg of the boot. This click is thrown in and out of action by means of a handle with which it is provided. In order to secure a boot upon this tree, the foot and heel-pieces are first brought together by raising the click *d*, clear of the teeth of the segment rack *c*, and then rocking the lever *b*, into the position shown at fig. 1; the boot being then slipped on, the handle of the lever *b*, is pushed back until the toe of the lever is arrested by the toe of the boot; the click *d*, will then fall into the rack-teeth, and hold the lever *b*, in position: the shield *f*, is now drawn forward until arrested by the leg of the boot being brought to tension; and the click *h*, then falls into the teeth of the rack *g*, and secures the shield in its forward position. To disengage the boot from the tree, it is only necessary to lift the clicks free of their respective racks. When cleaning short boots, the shield *f*, and its appurtenances, may be dispensed with.

When adapting the invention to the use of boot-makers, it is found desirable, instead of forming the lever *b*, with a fixed foot-piece, to allow of the attachment thereto of loose lasts. For this purpose, the lever *b*, is continued straight down to its termination, and a slot is formed through it to receive a tang projecting from the rear of the last, which may be secured in position by a wedge or pin, or other like contrivance. By thus adapting removable lasts to the tree, the boot-maker may tree up his boots with facility thereon; availing himself of the advantages which the improved tree offers, of slipping the boots on and off the lasts. When it is required to clean or tree long boots, it may be advantageous to joint the foot to the lever *b*, at the heel angle, by a kind of knuckle-joint, which will allow of the toe dropping a little, and thereby reducing the amount of lateral projection of the toe-piece.

The patentee claims, "constructing boot-trees in the manner and for the purpose above described."

To THOMAS HENRY DODD, *of Pimlico, for improvements in portable apparatuses for the use of smiths, carpenters, and other workmen.*—[Dated 5th October, 1859.]

THIS invention consists in constructing portable apparatus, comprising a set of smith's and a set of carpenter's tools, together with a carpenter's bench and turning lathe, and a smith's fire-pan, bellows, vice, and anvil; the whole being so constructed and arranged that they may be all packed in one strong case, which itself forms the bench and the support for the

lathe, vice, and fire-pan, when in use. By these means, accommodation is afforded for three workmen simultaneously—one at the fire and anvil, one at the bench, and one at the lathe.

In Plate II., fig. 1, is a plan, and fig. 2, a side elevation of a portable apparatus, constructed according to this invention. *a*, is a strong case, the sides of which can be removed; the top *b*, of the case is wide enough to serve as a carpenter's bench, as well as to carry a turning lathe *c*, which is driven by a strap *d*, passing round a variable speed-pulley *e*, through the top of the case, and round a second or larger variable speed-pulley *f*, on a crank shaft *g*, to which motion is imparted by a treadle. *i*, is a vice, fitted, as shown, to one of the sides of the case; *j*, is a bellows, held to the case by a forked support j^1. Motion is communicated to the bellows by a rod *k*, worked by a lever *l*, having its fulcrum at l^1. *m*, is a pipe leading from the bellows to a fire-pan *n*, and ending in a tuyere *t*. The fire-pan *n*, has a tool-holder n^1, connected to it; the back part of this fire-pan, when not in use, folds down, as shown by the dotted lines; the pipe *m*, is removed, and the pan itself slides off the bars *o*, *o*. *p*, is a drawer, working in slides beneath the top of the box, for holding tools; and p^1, is the lid of a compartment at the bottom of the case, for the same purpose. Fig. 3, is a view of an anvil *q*, which stands, when in use, on a block q^1; *r*, is a carpenter's bench screw; *s*, *s*, are handles for rendering the box or case as portable as possible.

To pack the box for carriage, the lathe is unbolted from the top, and placed in the lower part of the case upon the lid *p*, which is made strong to bear it; the vice is also unbolted, and placed against one of the sides of the case, where it is held by clips. The rod *k*, is unhooked from the bellows, and the support for the lever *l*, being removed, both are placed in the box. The anvil is removed from the block, and is held in the case by the clips *a**, *a**, and the block on which the anvil stands is placed at the bottom of the case. The fire-pan is held by clips at the top and bottom of the case. The bench-screw is removed, and placed in the case; the drawer *p*, is pushed in and fastened; the sides also are put in place, and held by screws *b**, *b**. The whole apparatus is then in very compact form, capable of easy portability.

The patentee claims, "the construction of portable apparatuses for the use of smiths, carpenters, and their workmen, essentially in the manner hereinbefore described."

To William Norton, *of Hollybank, County Cavan, for improvements in kilns for drying grain.*—[Dated 17th October, 1859.]

This invention relates to a novel arrangement of apparatus whereby the drying of grain may be both economically and efficiently performed.

In Plate II., fig. 1, is a transverse vertical section of the improved kiln, and fig. 2, is a partial plan view, showing part of the circular platform. *a*, *a*, are the walls of the kiln; *b*, *b*, is a perforated false bottom or hearth, beneath which is another bottom *c*, which is heated by the flame and gases from a furnace or fireplace *d*, placed below. Atmospheric air from the outside passes into a narrow space between the two bottoms *b*, and *c*, and, when heated, passes up through the openings in the bottom *b*, into the interior of the kiln, as indicated by the arrows. The

grain to be operated upon passes from a bin above, down a spout, on to a horizontal circular platform *f*, technically called a head. This platform consists of a frame formed of ribs, and is covered with wire-gauze or perforated metal, and is mounted on a vertical stud *g*, and is provided on its under side with a toothed rack *h*, *h*, into which gears a pinion *i*, on the short shaft *j*, which also carries a toothed wheel *k*, that is driven by another pinion *l*, on the spindle *m*. On this spindle *m*, is mounted a cylindrical brush *n*, which is driven by a band passed over a band-wheel n^1, at the outer end of the spindle.

From the foregoing description, it will be understood that, upon actuating the spindle *m*, a slow rotary motion will, by means of the pinion *l*, wheel *k*, pinion *i*, and rack *h*, be communicated to the horizontal circular platform or head *f*, on to which the grain is delivered, as before mentioned. It will be seen, that the brush *n*, rotates much more rapidly than the platform *f*, moves, and consequently it stirs up the grain on the platform, and thereby facilitates its drying. A small fixed brush or scraper *o* (fig. 2), is placed at or near the edge of the rotating platform, and as the latter moves round, the brush *o*, sweeps the grain into a spout or scoop *p*, whereby it is conducted out of the kiln, and is deposited in any suitable receptacle placed there for the purpose. Immediately under the rotating brush *n*, is placed an inclined channel *q*, on to which will fall any small seeds that may pass through the perforations of the circular rotating platform when the grain is stirred by the brush. By this means, these seeds are prevented from falling on to the heated hearth *b*, below, and will be conducted out of the kiln and deposited in any suitable receptacle. In order to confine the heat, the upper part of the kiln is enclosed with a wooden cover *r*, *r*.

The patentee claims, "submitting grain to be dried to the heat of drying kilns, and discharging the same therefrom, when dry, by the means above described."

To JOHN ARMOUR, *of Kilmarnock, for improvements in apparatus for measuring and for regulating supplies of solid and fluid substances in the preparation of mixtures or compounds.*—[Dated 26th October, 1859.]

THIS invention consists in constructing an apparatus, with a set of compartments or divisions, and furnishing the same above and below with revolving or sliding lids or covers formed with apertures in the same, or with fixed covers or lids with apertures, and revolving or sliding compartments placed between them, and so arranged as to allow solid substances in a ground, pulverized, or other like form, or fluid substances, to pass into and fill successively such compartments or divisions, from which they may be drawn off for use as desired. By these means, the quantities of ground fire-clay and water required for the manufacture of fire-clay of given consistencies, or the quantities of chemical or other substances requisite for the manufacture of manure, gunpowder, dough, and other compounds, may be measured and regulated with all needful exactness.

In Plate II., fig. 1, represents a sectional elevation of a machine constructed according to this invention, as applied to regulating the supply of ground fire-clay and water to the ordinary pug-mill. *a*, is the regulator for the clay; *b*, the regulator for the water: the mouths of these regulators are

placed over the mouth of the pug-mill *c*. The regulator *a* is made by preference cylindrical; the upper part of it forms a hopper for the supply of clay, which is fed into the regulator from the clay loft, the floor c^1, only of which is shown. The under portion of this regulator is divided into four compartments, with revolving lids or covers, placed over the top and bottom of the divided portion of the cylinder. The lids which are shown in plan at fig. 2, have a vacancy in each of them, placed reversely top and bottom, corresponding to the size of the divisions in the cylinder. When the upper portion of the hopper is filled with ground clay, the division under the vacant portion of the lid fills completely with clay. The lid, by revolving, places its vacant portion over the next division, which likewise fills, and so on, while the under lid consecutively opens each of these divisions, which thus discharges an exact measure of clay. The water regulator *b*, has a cylinder *d*, above it, which is fed from a cistern *g*, at the same level, and is consequently kept full of water, which is measured out in the same way as the clay. The revolving lids of both regulators are driven by a separate pair of cone pulleys *e*, and *f*, with speeds slightly graduating from each other. By this means, the supply of either clay or water can be reduced or increased at pleasure, and clay of any desired consistency can be brought from the pug-mill without any variation.

An arrangement of apparatus, similar in its essential features to that before described, may be employed for various other purposes with great advantage, such, for example, as the regulating of the chemical and other substances requisite for the manufacture of manure, gunpowder, dough, and other compounds.

The patentee claims, "the construction of an apparatus with a set of compartments or divisions, and furnishing the same above and below with lids or covers formed with apertures, in order to allow different substances (solid or fluid) to pass down in regulated supplies into one common receptacle, essentially in the manner described and illustrated."

To ÉTIENNE JUZET, *of Paris, for improvements in lubricating apparatus.* —[Dated 4th November, 1859.]

THIS invention relates to an improved oil box, for lubricating the axles of railway and other carriages, in which the journal of the axle is completely enclosed, so that no dust or foreign matters can enter; one half of the surface of the axle is also continually in the oil.

The figure in Plate II., is a central vertical section of the improved axle box. *a*, is the journal of the axle; *b*, the oil box; *d*, bearing; *e*, elastic bearing or ring, resting in a groove made in the axle. This ring can be made of india-rubber or gutta-percha. In that case the part coming in contact with the axle is covered with a thin sheet of copper, to prevent the dilation produced by the friction on the india-rubber or gutta-percha. If this ring is of common leather, its exterior part is surrounded with a sheet of india-rubber, to afford the necessary elasticity. This annular piece can also be made of wood or metal, in pieces, forced up by elastic packing. Instead of the ordinary arrangement, the groove may be dispensed with, and the ring placed on the circumference of the axle. *f*,

is a channel for the introduction of oil. Between the channel and the reservoir is a space enclosing air, which, by its pressure, forces the oil to remain at the same elevation, that is to say, half covering the journal. *g*, is the cover, faced on its inside with leather, thereby closing hermetically the channel *f*; *h*, is a spring which acts on the cover *g*, to close it; and *i*, are leaves of the springs of the carriage. In this box, the suspension springs of the vehicle are fitted into, instead of being held by a strap to, the upper part of the box. *j*, is a cover; and *k*, bolts holding the parts together.

The patentee claims, "First,—fitting the lubricating box to the springs *i*, as described. Secondly,—the application of an elastic ring or bearing surface *e*, hermetically closing the box towards the journal."

To JAMES CHESTERMAN, *of Sheffield, for new and improved methods of and furnace for heating, hardening, and tempering clock springs, watch springs, band saws, steel for dresses, such as crinoline steel, and other like purposes.*—[Dated 4th November, 1859.]

THIS invention consists, firstly, in a new kind of furnace made of metal or earthenware plates or boxes, having grooves through which the steel is passed to be heated; from thence it is passed between cold plates or through fluid, to harden it; secondly, after leaving the plates or fluid, it is conveyed over the top of the furnace, by which means it is tempered.

In Plate II., fig. 1, is a longitudinal section of a furnace constructed according to this invention, for heating, hardening, and tempering steel. *a*, *a*, is the outer brickwork of the furnace; *b*, is an iron tube extending from end to end of the furnace, and although only one tube is shown, yet several may be employed. The iron tube is surrounded for nearly the whole of its length by a casing of fire-brick a^1, a^1. *d*, *d*, are flues leading from the fires *c*, *c*; they pass round the fire-brick casings a^1, a^1, and meet at *e*, from which point the products of combustion pass off to a chimney. *f*, is a grooved metal plate, a plan of which is shown at fig. 2. The plate *f*, is placed in the flue *e*, and forms part of the cover thereof, in order that it may be heated by the waste heat passing off from the furnace. *g*, is a die or cover which fits into and upon the plate *f*; *k*, *k*, are cold dies of a similar construction to those described under a patent granted to the present patentee the 1st November, 1853; *l*, *l*, are rollers, the lower of which revolves in a trough containing oil; *m*, is a pulley, free to revolve on its axis. The steel spring or band to be tempered is led from a roller *h*, to the mouth of the tube *b*, and through this tube, wherein it becomes heated by the action of the furnace. On the steel leaving the tube *b*, it is passed between the cold dies *k*, *k*, where it becomes hardened; then between the oiling rollers *l*, *l*, round the pulley *m*, back over the furnace, and between the heated die *g*, and plate *f*, at which point the oil is blazed off, and the steel is tempered; it is then carried round a drum or drums, and so far as regards hardening and tempering, the steel is finished. In some cases, instead of the cold dies *k*, *k*, the steel band is passed through liquid lead, oil, or any other fluid. If oil is the fluid employed, then the oiling rollers *l*, *l*, can be dispensed with.

The patentee claims, "First,—the construction of a furnace for heating, hardening, and tempering steel springs, band saws, and bands, with a

tempering plate forming a cover or part of the flue thereof, as described and illustrated. Secondly,—heating, hardening, and tempering steel springs, band saws, and bands, by passing them through heated tubes, plates, or boxes, cold dies, and oiling rollers, or through oil or other liquid, back over the furnace used to heat the tubes, plates, or boxes, and through plates placed in the furnace flues, so as to become heated by the waste heat passing off from the furnace, essentially in manner described."

To George Spill *and* Daniel Spill, *both of Stepney Green, Middlesex, for an improvement in the manufacture of bands for driving machinery and for various other purposes.*—[Dated 9th November, 1859.]

This invention consists in forming bands for driving machinery, hauling up cages in mines, towing boats on canals, and for various other purposes in which great tensile strength is necessary, by combining bands or strips of steel or other metal, or metal wire, with textile fabrics and various other materials, in the following manner:—

A strip, or band, or wire of steel is covered with one or more strands of hemp cord, previously passed through a solution of caoutchouc, gutta-percha, glue, drying oils, gums, resins, tar, pitch, or other glutinous, gelatinous, or siccative materials. After the strands have been applied, the strip or wire is passed between rollers, in order to solidify the covering. Any required number of metal strips or wires thus covered are used as warps in a loom, and hemp cord or other like fibrous material, previously covered with a solution of caoutchouc or any of the other before-mentioned materials, or not, is employed to weave the whole together. The fabric thus produced is passed between rollers, to render it flat and smooth, and before or after so doing, a solution of caoutchouc, gutta-percha, or a coat of paint, or any other desired material is applied thereto.

The patentees claim, "the manufacture of bands by weaving together covered strips of metal with cords of hemp or other fibrous material, as described."

To Richard Archibald Brooman, *of Fleet-street, for improvements in mills or apparatuses for extracting oil from seeds, and for other purposes,—being a communication.*—[Dated 10th November, 1859.]

This invention consists in the employment of metal mortars in combination with metal pestles, for extracting oil from seeds, and in certain arrangements of machinery, by which such pestles and mortars are operated.

The figure in Plate II., is a sectional elevation of a mill constructed according to this invention. *a*, is a cast-iron frame, formed with a bearing *g*, through which a shaft g^1, works, which is supported on its opposite end by a bearing formed in a pillar *d*. The shaft g^1, carries fast and loose pulleys, *f*, f^1, round which a strap *s*, passes to a pulley *v*, on a driving shaft *t*. *r*, is a lever for throwing the strap from one pulley to the other; *e*, is a bevil pinion on the shaft g^1, in gear with a bevil-wheel *k*, keyed to the metal mortar *i*. This mortar is grooved on its interior surface, and

is supported by and works through guide-collars *b*, *b*, at its upper and lower ends. The lower collars *b*, *b*, are supported by uprights *h*, *m*, is a hopper, fitted to the mortar; *n*, a metal pestle; *o*, a wooden cap, linked to the pestle and to a series of levers l, l^1, l^{11},—l, l^1, of which are jointed to a bracket *c*, while l^{11}, connects the levers l, and l^1. The long arm of the lever l^1, carries a weight, and by changing the weight, the pressure on the pestle *n*, is regulated. *p*, is a rake for stirring the seed in the hopper *m*.

To extract oil from seeds with this mill, the seed is placed in the hopper *m*; rotatory motion is then communicated to the mortar through the bevil gearing before described, and as the mortar revolves, the rake stirs the seed, and the pestle presses it against the corrugated or grooved surface of the mortar, whereby the seed is crushed, and the oil extracted therefrom. The oil runs off through the bottom of the mortar into some vessel placed to receive it. In some cases, the mortar is fixed, and the pestle has an up-and-down motion imparted to it.

The patentee claims, "First,—the employment of metal mortars, in combination with metal pestles, for extracting oil from seeds, as described. Second,—the construction of oil mills in the manner described and illustrated."

To Alfred Vincent Newton, *of Chancery Lane, for an improved mode of clarifying and defecating saccharine solutions and juices,—being a communication.*—[Dated 11th October, 1859.]

Crude sugars, and the juices of sugar-producing plants, contain usually, besides crystallizable sugar, varying amounts of earthy and other salts, albuminous and other nitrogenous substances, colouring matter, &c., the presence of which, and the application of heat, are the causes of the deterioration of the sugar, in the making of the crude sugars, as well as in the after process of refining the same.

To effect the removal of these impurities, and to leave a purified or clarified solution, in which sugar alone remains dissolved, is the object and purpose of the manufacturer and refiner. In attaining this object, it is now proposed to employ alcohol in combination with water and heat. The presence of alcohol, as is well known, induces the coagulation of albuminous and other nitrogenous substances usually present in sugar solutions or juices. It has also so great an affinity for water, that its presence in a solution will attract the water in which earthy and other salts are dissolved, or held in suspension or separation, and thus allow the saline particles to be separated from the solution. It boils at a much lower temperature than water; and it does not dissolve sugar when cold, and little, if any, when hot.

Now the principle of this invention is to make the first two named properties of alcohol applicable to the separation of earthy and other impurities, from sugar solutions or juices, and at the same time to neutralize or overcome the fourth property, viz., the insolubility of sugar in alcohol; which property would render the application of alcohol to the clarifying or refining of sugars and juices impossible, as they require to be dissolved and maintained in solution in some medium.

To form and maintain a solution of the sugar, the alcohol is to be com-

bined with water in such proportion, and heated to such degree, as will retain the first two named properties of alcohol in full force; at the same time keeping the sugar of the solution or juices dissolved, to allow the separation and deposition of the albuminous and other nitrogenous, saline and other impurities, which is aided and effected by the low temperature, named as the third property of alcohol, without injury to the integrity of the sugar present.

The combination of alcohol and water found to work best consists of 60 per cent. of alcohol and 40 per cent. of water, or thereabouts, the per centage by volume according to alcohometry. The quantity of this combined liquid to be used is from 50 to 60 per cent., or thereabouts, of the weight of the sugar operated on.

The alcohol and water can be applied—First, to the expressed juice of sugar-producing plants, so much alcohol being added, as to combine with the water present in the juice sufficient to produce the combination of alcohol and water in the proportion above stated; and when the quantity of water is too great, it may be first evaporated, before the addition of the alcohol.

Second. Crude sugars to be refined are dissolved in the combination of alcohol and water, of the required proportions, as stated.

Third. Into sugars, previously dissolved in water, alcohol is mixed in such proportion as to form the combination of alcohol and water in the proportion as above stated.

A suitable proportion of alcohol being applied to the saccharine liquid or solution, as above stated, the mixture is heated gradually, until it reaches to near the boiling point. At this temperature it is maintained for half an hour, or thereabout, being subjected the while to constant stirring. In like manner, the brown or crude sugar solution is kept heated up and stirred for half an hour, or thereabout. The solution or the juice, after having thus been acted on, is drawn or decanted off into another vessel, and allowed gradually to cool down and settle. Care must be taken, while the solution is being heated and stirred, to neutralize any acidity which may be developed, by adding small quantities of milk of lime,—testing the same with litmus paper.

This combination of alcohol and water, while getting heated up and stirred, melts or dissolves the sugar when crude sugar is used; and the juices of sugar-producing plants, when operated on, in getting heated up as stated, and keeping same heated and stirred for the subsequent half hour, or thereabouts, with the gradual cooling, effects the separation of the vegetable albumen and other feculent or nitrogenous matters, earthy and other salts and impurities, which may be present, leaving a clear and purified sugar solution.

In about eight or ten hours the purified solution is drawn off from the sediment, and boiled down and crystallized.

The patentee claims, "the treatment of saccharine solutions and juices, as above described, for the purpose of obtaining a clear and purified sugar solution fit for crystallisation."

To WILLIAM EDWARD NEWTON, *of the Office for Patents,* 66 *Chancery-lane, for improvements in preserving and disinfecting organic substances,—being a communication.*—[Dated 17th October, 1859.]

THE principle of this invention consists in the employment of heavy hydrocarbons and oils extracted from mineral or vegetable pitch or tar, naphtha, bitumens, asphaltes, resins, balms, and other analogous carbonaceous matters. These hydrocarbons, in the proportion of 5 per cent., or even less, possess the property of preventing organic matters, either of animal or vegetable origin, from putrifying. They also possess the property of preserving organic matters for any length of time; and, by preventing fermentation in fresh substances, they will arrest decomposition in articles already undergoing a change.

The hydrocarbons which have the greatest preserving properties are those distilled under 150° heat of the centigrade thermometer. The oils, extracted at lower or higher temperatures, owe a certain amount of their preserving power to their containing a greater or less proportion of hydrocarbon, and the employment of these matters is included under this invention.

Liquid hydrocarbons may be applied, first, to blood, whether for the extraction of albumen or for the preparation of prussiates, and of Prussian blue; second, to skins of animals, whether intended to be tanned, dressed, or manufactured into fur; third, to the intestines of oxen, sheep, pigs, and horses, whether for the manufacture of catgut, goldbeaters' skin, or for other uses; fourth, to the refuse of slaughter-houses, and boiling and melting-houses, poultry and game which is too high, and all animal matters from which grease is extracted for the manufacture of soap; fifth, to the refuse of distilleries or to manufactories, from which alcohol is produced, but where the offensive smell given off causes these manufactories to be subjected to regulations which prevent the primary matters from being completely utilized, and which are, therefore, almost entirely lost; sixth, to the primary matters or refuse of breweries, starch manufactories, wash-houses or laundries, glue manufactories, and manufactories of train, fish, and animal oil; establishments for flaying animals, washing wool, manufactories of soap, tallow, bones, and glucose, tripe-houses, and generally all insalubrious establishments where nitrogenous and putrescent matters are employed; seventh, to threads, cords, cloths, and tissues of all kinds, whether made of hemp, flax, wool, silk, or other fibrous substances, and for woods of all kinds; eighth, to grain and seeds of all kinds, from which vegetables are produced; ninth, to the eggs of silk-worms; tenth, to substances which may be used as manures, such as guano, fish-refuse, horns, bones, and other analogous substances; and, eleventh, to alimentary substances.

In case the smell of the hydrocarbons should be objectionable at the time the matters preserved are required to be employed, this may be removed by treating them with sulphuret of carbon.

For common or valueless matters, the products of the most common pitch and tar are employed as disinfecting agents, and transportable products are thereby obtained suitable for use as manures for agricultural purposes. For substances which are required to be perfectly inodorous, or the color of which is not to be changed in any way, resinous oils, which are colorless or perfectly inodorous, are employed.

By the employment of this invention, the most offensive manufactories may receive their primary matters, prepare their products, and run off their refuse without giving off any noxious effluvia.

To THOMAS DIX PERKIN, *of King David Fort, St. George's in the East, for improvements in the manufacture of coloring matters,—being a communication.*—[Dated 15th November, 1859.]

THESE improvements in the manufacture of coloring matters are effected in the following manner:—To aniline, or one of its analogues (aniline is used by preference, both because it is easily obtained, and because the color it produces is, perhaps, superior to that produced by any of its analogues), there is added per-nitrate, sub-nitrate, per-sulphate, or nitrite of mercury, care being taken (whichever salt is employed) that it is perfectly free from water; the salt is added gradually, and until no further change of color or action is produced by it. The sub-nitrate of mercury is used in preference to the other salts above named, and from 6 to 8 parts of this salt will be required to be added to 10 parts of aniline, or of one of its analogues. The mixture, thus prepared, is heated, by preference, in an oil-bath, and caused to boil, when metallic mercury will be deposited; the boiling is continued until the mixture, which is then an oil-like liquid, becomes of a blueish-red color; this liquid is then, while it is hot, separated from the mercury, and on cooling, it will form a crystalline paste. The oily matter or color may in this form be sent into the market; and a dye-bath may be prepared from it, by simply boiling the oily matter or color in water. It is, however, preferred to boil the oily matter above mentioned in several successive waters, until no more color is extracted from it; these aqueous solutions are carefully filtered, and on cooling, deposit a great part of the coloring matter taken up, and by adding common salt to the water, practically, the whole of the coloring matter may be precipitated. The precipitate may be dissolved in alcohol or wood-spirit, and in this form it is very suitable for use in dyeing and printing on fabrics.

To JAMES GRAHAM, *of Warrington Junction, Lancashire, for improvements in treating and applying products obtained when galvanizing iron.*—[Dated 15th November, 1859.]

THIS invention relates to the preparing iron wire, sheet-iron, and iron articles, for the purposes of galvanizing, previously to passing them through a bath of molten zinc, intended to form the coatings, and consists in employing for such preparation the refuse made by galvanizers, in the process of galvanizing, termed sal-ammoniac dross or sal-ammoniac skimmings. This refuse is broken and crushed very small, and then boiled in water until all or nearly all the soluble salts contained in such refuse are dissolved. The solution is then drawn off into vessels, and any light particles or cloudings are allowed to subside. The solution is next transferred to a vessel, to boil and evaporate down from one-quarter to one-half of the bulk; and when in a boiling state, the iron wire, sheet-iron, or other articles intended for preparation, are placed in the solution,

the same being kept boiling until the surfaces become in a fit state to receive the coating of metal. When the oxide or coating is loosened, the articles are taken out of the boiling vessels, and the scales or oxide rubbed off by using a little sand. The sand is then washed off, and the articles are plunged again into the boiling solution, for a short time, when they are in a fit state to receive the coating of metal. As the solution keeps evaporating, it is to be replaced with fresh solution. The employment, as hitherto, of muriatic acid, is entirely dispensed with; and the finest wire may be galvanized without injury by the action of acids. The refuse left, after dissolving out as much of the salts as practicable, is transferred to a reverberatory furnace, and a very good oxide of zinc obtained, for reduction.

To THOMAS RICHARDSON, *of New Bridge-street, Newcastle-on-Tyne, for improvements in treating copper ores.*—[Dated 23rd August, 1859.]

IN treating copper ores according to this invention, the patentee reduces cupreous sulphuret to as fine a powder as possible, and then mixes it with about ten per cent. of common salt. It saves time to employ the common salt in solution in water and sea-water, or brine liquors answer equally well as a solution, made for this purpose by dissolving any kind of common salt in water.

The mineral, in the state preferred to be used, absorbs about 20 per cent. of its weight of water before it becomes sufficiently damp or moist for the operation; and as this proportion of water is sufficient to hold as much salt in solution as affects the process best, and as the quantity necessary to yield the above proportion of salt renders the mass too damp, or even wet, only so much of the saline solution must be thrown on the ores at one time as will make it sufficiently moist or damp to the touch. As the water evaporates, another portion of the saline solution is to be added with the same precaution, and this is to be repeated until the proportion of salt above mentioned has been applied. The mass of ore and salt is to be turned over, with wooden or copper shovels, or other instruments, from time to time, so as to present a fresh surface to the action of the air, and as often as possible. For the same reason, the layer of materials ought not to be spread too thick; a depth of from 6 to 12 inches being well adapted for the promotion of the chemical action which ensues. During the whole of the operation, the temperature of the materials should not be allowed to fall below 80° Fahr., nor to rise so high as to cause a too rapid evaporation of the moisture. When the materials appear dry, fresh quantities of water must be added, so as thoroughly to moisten them, in which condition the process proceeds most rapidly. The process ought also to be conducted in a locality which has a floor or bottom impervious to water, and where the surrounding air can be maintained in a moist state at nearly the same temperature as the materials. Muriate of potash may be substituted for the common salt.

For the conversion of copper into a soluble sulphate, the patentee treats those ores which are used in the manufacture of sulphuric acid in the form of large pieces in kilns. He extracts, by water, whatever portion of the metal is soluble, and reduces the residuum to powder. This ground residuum is mixed with fresh copper or iron pyrites in powder, in the proportion of 10 per cent., and submitted to a dull red heat in an ordinary

reverberatory furnace. The roasted material is then treated with water, to remove the soluble salt of copper, and the process is repeated as often as is necessary to separate all, or nearly all, of the copper in a form soluble in water.

Or the patentee takes any materials containing carbonate or oxide of copper, and mixes them with about 10 per cent. of iron or copper pyrites. This mixture he grinds to a fine powder, roasts, and lixiviates it, as already described. If the residuum contains any copper in an insoluble form, the operation is repeated until all, or nearly all, of the copper is obtained in the aqueous solution. Instead of these repeated roastings of the above mixture of ore and pyrites, the process first described may be employed, and the copper rendered soluble in water by means of muriate of soda or of potash, moisture, and a sufficient degree of heat in a suitable locality.

In all these operations, the copper gradually becomes soluble in water; and the point at which the process is completed may be easily ascertained, by treating an average sample of the mass with sufficient water to remove all the soluble copper, then dissolving the residuum in an acid, and adding ammonia; when the well-known blue color will be imparted to the liquid, if any copper be present.

When the various operations are finished, the materials are thrown into suitable shallow cisterns, and the copper dissolved out by means of water. It is advisable to employ heat, to assist the solution of the copper, and to perform this operation in leaden cisterns, with wooden utensils. The cupreous solutions are run into cisterns, and the liquid acidulated slightly with sulphuric acid, before precipitating the copper in the usual manner, by means of iron or zinc.

To JOSEPH TOUSSAINT, *of Welbeck-street, Cavendish-square, for a new process of modelling and moulding for galvano-plastic.*—[Dated 30th April, 1859.]

THE following is the mode of proceeding:—A natural leaf is placed on a plate of modelling wax, and with a brush a coat of spirits of wine is given thereto, and before it has evaporated, the leaf is brushed over with pure water with another brush. During this first operation, some fine modelling plaster is mixed, and spread equally over the wet leaf. This operation requires great attention, and ought not to occupy more than one or two minutes, so that the plaster may soak up the water on the leaf, and take the impression with all the beauty of nature. After having thus operated upon one side of the leaf, the plate of wax is taken up without any trouble or preparation, as it does not adhere to the leaf; a fatty matter is spread on the borders of the plaster, which projects from the leaf about ½ an inch. This fatty matter is generally composed of 14 oz. of common oil and 3½ oz. of lard; the greasing is necessary to prevent the adherence of the second operation in plaster, which is done in the same manner as the first, to obtain the reverse of the leaf. By the help of a pointed knife introduced in the joints, the separation of the plaster moulds is easily obtained, and these are then put to dry in a stove, and when properly dried, they are thrown in their heated state into a bath of pure boiling tallow or stearine. This operation is to prevent the destruction of the moulds at the time of galvanization in the baths. On taking out the

moulds from the bath of clean tallow, they are put into a basin in a bath of boiling turpentine, with which they are bathed by the help of a large ladle, in order to get rid of the fatty matter which is upon the surface of the moulds, and obstructs the beauty of the leaf; this operation has the effect of rendering the moulds clean for the reproduction. To obtain a vase or plate with flat leaves of their natural thickness, the imprint of the vase or plate is taken with the wax composed as before; the leaves are then placed upon this wax form, fixed with pins, and the whole is moulded by the same process as that already explained.

To render the moulds metallic before putting them in the galvano-plastic baths, 2½ drachms of nitrate of silver, dissolved in 5 drachms of distilled water, are mixed with five drachms of spirits of wine, and a coating of this liquid is given to the moulds. To know whether the metallization is complete, an infusion is made in a two-necked bottle, generally used in chemistry, of the following:—3⅛ oz. of muriatic acid, 9⅜ oz. distilled water, 5 or 7½ drachms of sulphur of barytes or barium, and, by means of india-rubber pipes connecting the bottle with a bellows, the vapour produced by the mixture of the above is directed upon the moulds, and if the metallization has been properly effected, they instantly become black. If any parts of the moulds have white spots upon them, it proves that the metallization is not complete on these parts; this must be remedied by operating with a brush upon these spots, and giving them one or two coats of a new liquid composed of 2½ drachms of nitrate of silver dissolved in 1 oz. 2 dr. of volatile alkali; after which the metallization is again proved by directing the vapour as before upon these white spots: in this case they will become black, and the operation is complete. They are then placed in the galvano-plastic bath in the same manner as if they were blackleaded, so that a deposit of metal may be obtained. To obtain a mould of leaves, flowers, or fruits, in hollow, the opposite side of the leaf, of which the impression in hollow is to be obtained, is furnished with a plate of gutta-percha or wax; ¾ oz. of virgin or white wax is dissolved in 6 oz. 2 dr. of turpentine, and, by the help of a brush, a coating of this liquid is laid on the copper relief, the hollow of which is to be obtained, in order to prevent the adherence of the two coppers; it is then placed in the galvano-plastic bath, and when the deposit of copper is made by the ordinary proceeding, the two leaves of copper are separated by means of an implement, and they are thus obtained in hollow.

If the matrice is too weak in copper, it is remedied by thickening with a coating of brass. Flower moulding is done in the same manner as the leaves, but without spirits of wine or any preparation before laying on the plaster, except water sprinkled on them with the mouth or a rose.

Fruit-moulding in bunches is done in the same manner as the leaves, that is to say, wetted with the spirits of wine, then with water, and then with the moistened plaster very clean. When the fruits are smeared over, they are placed upon three small square pieces of dry plaster prepared beforehand, and ½ inch thick, which are covered with some of the moistened plaster, so as to make fast the fruit. A silken thread is laid on the fruit with ends about 8 ins. on each side, and they are then all covered with a second coating of plaster about ½ in. or 1 in. in thickness; and while the plaster is yet in paste, by means of the ends of the thread the mould is cut in two, and the separation of the fruit is obtained. The round pieces of

wood used for ornament or the accompaniment of vegetables are moulded in gutta-percha in two shells, in the same manner as the round bunches in bronze, and are metallized the same as the plaster moulds.

The mode of employing leaves, flowers, and fruits, as ornaments for frames, pedestals of clocks, vases, gold filagree work, and trinkets, and their reproduction in galvano-plastic, is as follows:—

Modelling wax is prepared as before. The following is then melted:— 2¼ lbs. of yellow wax, 10½ oz. of resin, 14 oz. of yellow or red ochre, 1 lb. 1½ oz. of potato-starch, 3½ oz. of lard; these quantities are according to the temperature; the lard is augmented in winter, and the weight of the wax or resin in summer; the composition is allowed to cool in a covered vase, and before it is completely cold, it is taken from the vase, and mixed with the hand till it becomes very elastic paste, which is made into little sticks, and rolled into plates about $\frac{1}{16}$ in. thick, with a wet roller upon a board, also wetted with a sponge; the leaves are placed on this plate of wax, and, with a needle in a handle, the wax is cut in the same form and dimensions as the contour of the leaf, which admits of any thickness being given to the ornament. Before applying the leaves, flowers, fruits, or wood composing the ornament, in the form of frames, vases, &c., in wood or dry paste, a light coating of the fatty composition above is laid on the forms, in order to prevent adherence; the ornament is then grouped, the wood, the fruits, and the flowers are fixed in the form to be *moulded*, by means of pins and needles, and the whole is then operated *upon* by the same means as before. Before removal from the mould, the pins and needles must be withdrawn, and care must be taken that the plaster moulds are not quite cold, although hard.

The wood, leaves, flowers, and fruits are now taken from the mould. To do this easily, the moulded vegetables are exposed for a few minutes in the stove; when this is done, the moulds are dried in the stove as above, they are then metallized and galvanized. Reptiles, insects, and birds are moulded in the same manner as the vegetables; shells are moulded in gutta-percha and gelatine.

To AUGUSTE PIN, *of Castelnaudary, France, for the compounding, preparing, and application of a new sort of paint.*—[Dated 3rd August, 1859.]

THIS improved paint, which is hydraulic, and unaffected by washing or the action of water, is obtained by the preparation of an "hydraulisator," and by the preparation of colors capable of being hydraulicised by application to surfaces coated with white, or by admixture with this white. The two elements of hydraulic painting are composed and prepared as follows:—The hydraulisating white has a calcareous base, and, in composing it, those stones are chosen which, when calcined, produce fat limes, —those with close grain, compact, and sonorous principally; such as are hydrated become, after desiccation, almost as firm as the stones which have produced them. These stones are so calcined as not to be entirely slacked, so that, by their extinction, they may produce a coarse paste, composed simply of broken parts. The blocks resulting from the calcination are to be saturated with dilute muriatic acid, and dried by expo-

sure to the air, or in stoves. After desiccation, the stone is reduced to a coarse powder, by any mode of trituration. To twenty-five parts of this calcareous powder are added one part of phosphate of soda, one of sulphate of zinc, one of glucose or syrup of potatoes or sugar, and one of wax-soap. This mixture having been made with the greatest care, the hydraulisating white is prepared, and should be then packed, so as to protect it from the influence of the air, or any humidity. The colors capable of being hydraulicised by their application upon or admixture with the white thus prepared, are prepared in the following manner:—Chlorhydrate of zinc is prepared by dissolution of the metal in a bath composed of equal parts of water and muriatic acid. After the saturation of the solution, ten parts of water are added: then, by filtering, the zinc which has not been dissolved is removed, and carbonised during the operation. A mixture is next prepared by dissolving potash, rendered caustic by lime, at 10 °/₀, and an equal quantity of syrup of potatoes at 33 °/₀. To this mixture are added four or five parts of pure water, and a loaf of sugar is placed therein, and ground down, so as to obtain, by its complete melting, a liquor similar to the thick oils used in oil painting. To this liquor is added equal parts of wax-soap, to form, by its admixture, a more or less solid paste, according to the degree of firmness of the wax-soap used. It is with this paste that the ordinary colors will be ground. The colors will be damped with pure water, to facilitate their mixture with the wax-paste in nearly equal portions, forming a firm and heavy paste,—capable of being ground. During the grinding, a few drops of the composition of syrup of potatoes and solution of potash are added, as much to give the colors the shining surface of oil-colors, as to facilitate this operation, and obtain these colors in an almost impalpable state. These prepared colors are then diluted with pure water, until brought to the same consistency as those used in aquarelle, or water-color, or sepia painting. All colors may be used in hydraulic painting, except Prussian blue, which may be replaced by indigo, or any other blue which will resist lime. The hydraulisating white is used and applied as follows:—The white is diluted with pure water, for about twenty-four hours, in order that the different substances of which it is constituted may decompose and act upon each other. It is then ground with the greatest care, to obtain it in an impalpable consistence. It is then diluted, and rendered more or less liquid, according to the degree of thirstiness of the surfaces to which it is to be applied. It should be applied in light and scarcely visible coats,—moving the brush continually backwards and forwards, to equalize each coat and close the porosities; and no fresh coat should be given until the entire desiccation of the previous ones, to avoid the cracks and flaws which would quickly appear without this precaution. When it is desired to color this white, and to obtain different shades of color, not more than one part of color should be added to three or four of white. After having painted the surface with white, whether alone or mixed with the colors, it should be well brushed, previous to the application of one or more coats of a wax-soap water, composed of twenty parts of water to three of well-ground soap; the coats of this preparation, after thorough desiccation, must be brushed the one after the other.

To apply the prepared colors on surfaces coated with the hydraulisating white, after putting on several coats of the white, care must be had not to brush them, so that they may retain their permeability; but if a

smooth surface for careful painting be required, they may be rubbed down with glass-paper, or otherwise. The property possessed by the prepared colors, of becoming hydraulic by their application on the white, being due to the property which it possesses termed permeability, before applying the colors, the degree of permeability of the several coats of white should be ascertained, in order to place the colors in a proper state of liquidity, diluting them with water as much as possible, but not so as to permit them to blister, which will be ascertained by practice. These colors, properly treated with the brush, as those used in oil painting, may be used for all hard, rough paintings, such as woods, marbles, and house-painting, adding white to the colors when required, such as the ground of a wood, and the veins or other accidents in marble. Paintings executed according to this process are brushed when dry, and several coats of wax-soap are then applied, as before stated.

When applying these prepared colors in the execution of artistic painting in buildings, such as frescoes, and all large mural paintings, the white is mixed with the colors in variable proportions, such as are necessary to produce the tint required. Suppose, for example, that it is desired to paint a head, a carnation, or draperies:—the patentee begins by placing coats of color of the clearest shades of color of each object, and then places the shades and last tints with colors prepared without the addition of the white; and, with a brush slightly moist, the blending of the colors is obtained. It is, however, obvious that the ability of the painter cannot be supplied; but what is recommended is, to paint at one stroke boldly, without hesitation, but with great care and attention. Several coats of soap-water should be applied, so as to make no dirt, or leave white traces of the wax-soap.

The patentee claims, "the exclusive use of a new sort of paint, compounded, prepared, and applied as set forth."

To JAMES CHILDS, *of Windsor-house, Putney, for improvements in the manufacture of night-light cases.*—[Dated 2nd May, 1859.]

HERETOFORE, in manufacturing night-light cases, where bottoms of plaster, cement, or of other material are used, such bottoms have been introduced into or made in the cylindrical cases of paper or wood after the same have been first formed. The present improvement consists in forming the cylinders of paper or wood on to the bottoms of plaster, cement, or other material, thus forming the upper parts on the bottoms.

The cement bottoms are made of plaster of Paris, mixed with hot liquid size or glue. The mixture is poured on to a slab of metal, the surface of which has been previously oiled, and the mixture then flows over the surface and produces a layer or sheet of about $\frac{3}{16}$ths of an inch in thickness. When the layer or sheet has commenced to harden, and is of the consistency of dough, circular pieces, of suitable size for the bottoms of night-lights, are cut therefrom by means of circular or ring punches. The remnants of the layer or sheet may be used over again with the next batch of plaster of Paris. For this purpose, they should, while in the doughy state, be stirred into, and thoroughly mixed with, the compound of plaster and size, or glue, when the same is ready to be poured. The cases of the night-lights which it is preferred to form from sheets of paper and wood,

such as are commonly used for the cases of Child's night-lights, are cut into strips equal in width to the depth of a night-light, and in length to about one-and-a-half times its circumference. In making a night-light case, one strip of paper and one of wood are employed; the paper strip is pasted on the inside, and the wooden strip on both sides; the wooden strip is then laid on the pasted side of the paper strip, so as just to cover it, excepting a short piece at one end. A disc of plaster pasted round its edges is then taken and placed at the end of a mandril, of the size of the interior of the night-light, and is there held while the mandril is laid on the previously prepared strips, which are then wound round the mandril, so that the edge of the wooden strip becomes pasted all round to the plaster disc, and the strips, where they overlap each other, also become pasted together, the joint being neatly finished by the projecting end of the paper strip, which prevents the wood appearing at the side of the case; the case is afterwards furnished with a wick supported by a foot of tin-plate, and is filled as heretofore practised.

The patentee claims, "the manufacture of night-light cases, by wrapping or forming the cylinders of paper or wood on to the bottoms of plaster, cement, or other material, as described."

Scientific Notices.

INSTITUTION OF CIVIL ENGINEERS.

May 22nd, 1860.

GEORGE P. BIDDER, ESQ., PRESIDENT, IN THE CHAIR.

The paper read was, "*On breakwaters,*" Part II., by Mr. MICHAEL SCOTT.

THIS communication was in continuation of a former paper, read in December, 1858. It consisted of two parts,—the first being an account of the completion of the Blyth breakwater, the second a description of a new kind of breakwater.

It was stated that, since the date of the former paper, the breakwater at Blyth had been completed with entire success, and with the greatest ease, notwithstanding a cross-current of $3\frac{1}{2}$ miles an hour. Having been exposed to the violent storm of October last, without sustaining the least injury, it was claimed that experience had afforded a complete answer to the objections made, during the previous discussion, to this kind of breakwater, which consisted of timber frames, deposited in deep water, planked and filled with stone.

It was shown that 20 lineal feet of the Blyth breakwater could be completed per day, and that the system of depositing frames was cheaper than piling.

It was also argued, that such breakwaters were stronger, cost less, and could be erected in less time, than any arrangement previously in use. The round end was constructed on the principle of basket-work,

and the advantages of this arrangement were pointed out. The cost of the breakwater, including the round end and the light-house, was stated to have been £11 per lineal foot. Four years' experience had shown, that properly creosoted timber was not touched by the worm.

In introducing the new kind of breakwater, it was observed, that there were situations to which no structures hitherto used would be applicable, as there were conditions which none of them fulfilled. It was the consideration of these which led to the present design. Reference was made, for the sake of illustration, to Table Bay, Cape of Good Hope.

It was stated, that difficulties had been experienced in finding a suitable breakwater for that locality, arising from the magnitude of the waves. A breakwater, with a slope like that at Plymouth, was not adapted for the locality, because the sea would roll over it, and because it was costly to construct, and to keep in repair. The form of the breakwater at Alderney was not suitable, because the waves would break on the work, which could not be expected to withstand the blow of such enormous waves as those at the Cape of Good Hope. Besides, it was expensive, and tedious to construct. The same observations applied to the forms of the breakwaters at Holyhead and at Portland, and, if such a form gave way, the harbour would be ruined, by the stones being strewn over the anchorage. A vertical wall, built either from the bottom, as at Dover, or from the depth below low water, at which stone ceased to be disturbed by the sea, was correct in principle; but the height of the parapet necessary to receive the rise of such waves, and the breadth of the work necessary for stability, would be so great as to render this form unsuitable. Moreover, as the waves were not only large, but were said to be breaking, on the site of any harbour which could be arranged, the vertical wall was not applicable.

The new kind of breakwater was a modification of the wave-screen described in the former paper. Although similar in principle, it differed in the materials of which it was constructed, and it was applicable to deep water. It was proposed to deposit a bank of rubble stone, up to the depth below low water at which stone began to be disturbed by the action of the waves. Upon this bank would be built a face wall, up to low water mark, and behind this wall long counterforts, the upper surface of which would rise from low water at an inclination of say 2 to 1, and extending back for a distance dependent upon the extent of the slope rendered necessary by the magnitude of the waves. These counterforts would be so far apart from each other as could be conveniently spanned by iron girders, suppose 20 feet; and the whole of the sloping surface would be converted into a sort of gridiron, by girders laid from counterfort to counterfort, at distances of about 18 inches apart. Supposing such a breakwater to be exposed to a heavy sea, whether the waves were breaking or not, the water would be projected up the slope, and would gradually drop through on its passage. This operation being diffused over a large surface, the water thus dropping through could not reproduce a wave, and the only effect would be, a stream of water into the harbour. Thus, it was stated, that this form differed in principle from all vertical screens or gratings, which, by permitting the wave to pass through at the same instant of time, had not the effect of destroying the undulation. It was desirable that the breakwater should

be placed at an angle with the direction of the greatest sea, so that the wave should not only run up, but along it, especially in such a place as Table Bay, where the waves were of such magnitude. It was contended that this breakwater would be strong, durable, easily and quickly constructed, and cheap. A breakwater for Table Bay would cost, at prices current in this country, under £80 per foot run; and, what was important for a work executed abroad, the whole of the ironwork could be exported in a finished state.

The discussion upon this paper was continued throughout the evening, and, not being concluded, the President announced, that the subject would be re-opened at the first meeting of the ensuing session, in November next.

THE paper "*On the method of computing the strains and deflections of continuous beams, under various conditions of load, &c.*," by Mr. J. M. HEPPEL, was stated to be of so purely mathematical a character as to be unsuited for reading. It would be published in the Minutes of Proceedings, and, in the meanwhile, it would suffice to mention, that the method proposed was, in its main features, identical with that given in Professor Moseley's "Mechanical Principles of Engineering and Architecture," and so successfully followed, in the deduction of practical results, by Mr. Edwin Clark and others. The chief points in which the present investigation differed from others previously used were, that in estimating the action of forces, more aid was derived from the theory of couples, and in considering the pressures on the bearing points, the two parts of each such pressure, arising respectively from the portions of the beam on either side of it, were always kept separate and distinct. It was believed that, in this way, the means could be arrived at of dealing with all the conditions of a continuous beam, with little more labour, or complexity of calculation, than if it were a succession of independent beams.

A paper was announced for reading, early in the ensuing session, "*On the measurement of gas, and the classes of gas-meters in general use*," by Mr. WILLIAM CROSLEY.

THIS paper stated, generally, the facts connected with the early introduction of gas-lighting, and its progress up to the present day, when the rental amounted to about five millions of pounds sterling per annum, and the consumers to several millions of persons, supplied by upwards of one thousand companies, corporations, or private proprietors of gas-works. With a view of ascertaining the quantity consumed, otherwise than estimating by burner, the gas-meter was introduced by Mr. Clegg and the late Mr. Samuel Crosley. This instrument, after having been in use for some time, and being modified by other persons, was still found not always to be relied on for correct registration. The general complaints from the consumers of gas led to the passing of an Act, in the last session of Parliament, to insure a more constant inspection of the instruments for measuring gas.

Details of a series of experiments on meters of various designs and

construction, were given, showing how great an amount of error prevailed. At the same time, remedial measures were pointed out, and discussion was invited upon the best instruments for use, and the most effectual systems of supervision.

INSTITUTION OF MECHANICAL ENGINEERS.

Jan. 25, 1860.

JAS. KENNEDY, Esq., President, in the Chair.

At the thirteenth annual general meeting, held at the house of the Institution, Newhall Street, Birmingham, the following paper, being a "*Description of an improved gas-meter*," by Mr. Alexander Allan, of Perth, was first read.

In the ordinary construction of wet gas-meters, the accuracy of measurement depends on a true water level being constantly maintained in the meter; and as there is a continual waste of water from evaporation, independent of any leakage or abstraction, this waste must be compensated for in order to prevent the measurement being rendered incorrect. Hitherto, the gas-meters in common use have been made to register 5 per cent. against the consumer in the first instance, and afterwards, by gradual waste of the water, to register up to 5 per cent. in his favour, so as to give a correct result on the average. By a recent Act of Parliament it is now provided that no meter shall receive the Government inspection stamp which is capable of registering more than 2 per cent. against the consumer, or 3 per cent. in his favour, thus allowing a margin of 5 per cent. for error of measurement. In other standards of measure, however, no such allowance is made on either side; and, accordingly, in the improved gas-meter, forming the subject of the present paper, the writer's object has been to provide the means of practically compensating for the gradual waste of water, so as to obtain a meter that will continue to measure correctly under all circumstances, and thereby require only about one-tenth of the customary inspection. This is accomplished by means of a pneumatic fountain, forming the usual square front of the meter, by which the water level in the meter is maintained constantly at the correct height.

The square front of the meter is raised so as to form the supply-fountain. It is arranged to hold in suspension about 840 cubic inches of water, to compensate for waste. The fountain communicates with the drum case by means of a small hole a little below the proper water level. A dip-pipe, open at top to the gas space in the meter, passes through the partition into the fountain, to the level at which the water is to be maintained in the drum.

As the dip-pipe is open at top to the gas space of the meter, there is the same pressure on the surface of the water at the bottom of the dip-pipe as on the water in the body of the meter, and the water cannot rise in the dip-pipe. Hence, when the least quantity of water is withdrawn from the meter by evaporation, or otherwise, a bubble of gas will emerge

from the bottom of the dip-pipe, and rise into the fountain; thus allowing exactly the same quantity of water to pass from the fountain into the meter, which at once restores the true water level. This action will continue as long as there is any water in the fountain to supply the waste. A float is arranged in the fountain, to close the gas inlet-valve, and shut off the gas when the supply of water in the fountain becomes exhausted.

The dip-pipe cannot cause any accumulation of water in the meter above the proper level; but should this occur through any other cause, an overflow-pipe is fixed, so that the meter cannot be overfilled. The overflow-pipe is brought forwards in advance of the dip-pipe, so that if the meter be tilted forwards with the view of making it register less than the quantity of gas consumed by lowering the mean water level inside the meter, the water flows out of the drum-case into the waste water-box, and intercepts the passage of the gas by closing the orifice of the pipe leading to the interior of the drum. Should this abstraction of water from the meter be continued, by taking out the plug in the waste water-box, and allowing the water to escape through it, the dip-pipe will come into action, and supply the water from the fountain, till the latter is empty, when the float will fall, and close the gas inlet-pipe; and the meter must be restored to its proper level position before gas can be obtained through it. The abstraction of gas from the waste water-box is also prevented by inserting therein a pendent partition; and by elongating the tube of the discharge plug.

The supply-fountain can be refilled at any time without interfering with the action of the meter, through a filling-tube, which descends below the bottom of the dip-pipe; and the gas that may have accumulated in the upper part of the fountain-chamber above the water, escapes through an exhaust-pipe into the meter; the bottom of this pipe is effectually closed against a return of gas by being submerged a little below the true water level. The hole communicating between the fountain and the drum-case requires to be bushed with block-tin in cast-iron meters, to prevent oxidation by the passage of water through it.

In a simpler arrangement of the meter, the inlet-pipe leading into the drum is made to act also as the overflow-pipe, so that, in the event of the meter being overfilled, so as to register against the consumer, the surplus water flows into the waste water-box. In this instance, a fraudulent abstraction of gas from the waste water-box is prevented by a right-angle waste-pipe, the pendent limb of which dips down sufficiently far to prevent the water being forced out by any pressure of gas adopted in practice.

In reference to the exhaust-pipe by which the gas accumulated in the fountain escapes into the meter when the fountain is being refilled with water, it may be remarked, that if the dip-pipe should become accidentally obstructed, the water level inside the meter cannot fall below the bottom of the exhaust-pipe; for as soon as it falls low enough to uncover the bottom of the pipe, gas will pass up through the pipe into the top of the fountain, and allow enough water to flow from the fountain to bring up the water to the level of the bottom of the exhaust-pipe. When the exhaust-pipe is extended from the fountain to the back of the drum case, and there made to dip slightly below the water line, the advantage is gained of entirely preventing the meter from being tilted forward; for if this is attempted, in order to make the meter register against the company, the

orifice of the exhaust-pipe at the back of the meter becomes uncovered, and gas passes into the fountain, allowing a compensating supply of water to pass into the meter; thus entirely preventing fraud by tilting. The exhaust-pipe may be employed in this manner either by itself or in combination with the overflow-pipe previously described. By determining the depth to which the exhaust-pipe is submerged at the back of the meter below the true water level, the limit of tilting may be fixed, so as to allow of any small accidental inclination of the surface on which the meter has to stand; while gas cannot be obtained through it if tilted designedly beyond this limit.

As to the length of time that the fountain will serve to maintain the true water level without requiring refilling, if the evaporation of water from the meter be taken at one cubic inch per 1000 cubic feet of gas, about double the ordinary rate of evaporation, the supply of water in the fountain being 840 cubic inches, will preserve the water level unaltered during a consumption of nearly one million cubic feet of gas.

Mr. J. E. Clift thought the plan of meter was a very efficient and satisfactory one for the purpose of maintaining the required accuracy of measurement, and it was an important and valuable improvement, as the construction was so simple and free from all parts liable to the objection of getting out of order or impeding the action of the meter. He had seen one of these meters tested, and it preserved accuracy of measurement under all circumstances, within the limits allowed by the parliamentary regulations; and there was no difficulty in making any number of the meters to work with equal accuracy.

Mr. C. W. Siemens had known several other plans tried for the purpose of maintaining the correct water level in gas-meters, and it was important to obtain a really trustworthy meter that could be relied upon to continue correct for a long period without attention. One of the plans had a small wheel, turned by the meter, lifting drops of water continuously, to maintain the water in the meter up to the required level; the surplus water running back into the supply reservoir: the ordinary bird-fountain had also been tried before, but had not proved successful. He was much struck with the ingenuity displayed in the present plan in getting so simple a principle to accomplish the object, without involving the necessity for any moving parts or machinery; and the pressure of gas being the same on both of the water surfaces, their level was undisturbed by any variation of pressure. The arrangement for preventing the measurement being affected by tilting the meter, was also a simple one; and the several precautions in the construction of the meter rendered it very complete.

The following paper was next read—"*On the application of superheated steam,*" by Mr. John N. Ryder, of London.

Since the important subject of superheated steam was brought under the notice of the members, by the interesting paper read by the President at the Leeds meeting last year, rapid progress has been made, and an evident desire manifested by many large consumers of steam-power to learn more upon the subject with a view to its adoption. Yet, hitherto, much indecision has been unnecessarily caused, in many cases, by erro-

neous views as to danger in the application of superheated steam and doubtful economy in its use. It therefore becomes necessary that these questions be determined by an investigation of the subject, in order to arrive at trustworthy conclusions. The writer proposes to introduce the subject by a description of two arrangements for superheating steam—the one by Messrs. Parson and Pilgrim, of London, and the other by Mr. David Patridge, of H.M. Dockyard, Woolwich; giving in each case the practical results of the employment of superheated steam.

In Messrs. Parson and Pilgrim's arrangement of superheating apparatus, as applied to marine engine boilers, the superheating pipes, bent to a semicircular form, are placed in the furnaces; their number being dependent upon the temperature required. A pipe from the steam-chest conveys the common steam to these pipes, in which it is superheated, and then passes off to the engines. A trial of this apparatus was made about two years ago with a 10-horse-power boiler, connected with an engine having a brake applied, in order to ascertain the possibility of regulating the extent of superheating, and of using superheated steam direct in the cylinders of steam-engines. A number of experiments were tried for a period of nine months, both with common and superheated steam, and the following results were obtained:—By using superheated steam, one-third less water and one-third less fuel were consumed, and in many cases, one arched pipe gave a sufficient amount of superheating surface to realize the benefit of the plan to that extent of economy. This apparatus was applied about a year ago to a stationary boiler in the Royal Arsenal at Woolwich, and was tested for 64 days, when the result arrived at was that a saving of 30 per cent. was effected by its use.

Much opposition was, however, experienced to the employment of superheated steam, and consequently a full investigation of the chemical question involved was made by Professors Taylor and Brande, as to the effects of using superheated steam, and the alleged danger from explosion attending its employment. Experiments were made with a steam-boiler that was working with this superheating apparatus, and the following results and conclusions were arrived at by them:—The steam was issuing from the boiler at a pressure of 20 lbs. per inch, equivalent to a temperature of about 264° Fahr.; and after traversing the iron superheating pipes, heated to redness at the back of the furnace, its temperature, in passing into the steam-chest, was found to vary from 484° to 540°, the pressure remaining unchanged. As the steam escaped from a jet, and before it had assumed a state of visibly condensed vapour, it immediately extinguished the flame of burning paper. The superheated steam was then received and condensed in a vessel of water, under such circumstances as to allow of the collection of any gases which might be mixed with it. Two portions of gas were thus collected and carefully examined: the result was, that no hydrogen was present, nor any inflammable gas or mixture of gases. The incondensible gas, which was then collected from the condensed vapour, was found to extinguish the flame of a candle, and was apparently nothing more than nitrogen derived from air contained in the water and liberated by heat. The oxygen of this air is fixed by the iron of the red-hot pipe, while the nitrogen, constituting from $\frac{2}{3}$rds to $\frac{4}{5}$ths of the air, is set free, and escapes with the superheated steam. Although steam passed over pure metallic iron, heated to redness (1000°), is so decomposed that the oxygen is fixed by the iron, while hy-

drogen gas is liberated, this chemical action is of a very limited kind; and in order to obtain any considerable quantity of hydrogen, a very extended surface of iron is necessary, as in the form of thin plates or iron turnings; for the surface of the iron is rapidly covered with a fixed and impermeable layer of the magnetic oxide of iron, and thenceforth the chemical action is completely arrested. If the interior of an iron pipe has been already oxidized, by passing through it, while in a heated state, a current of air, there will be no decomposition of the steam during its passage through it: if the interior of an iron pipe were not thus previously oxidized, it would speedily become so by the oxygen derived from the air, which is always mixed with the steam. Hence, chemically speaking, under no circumstances would any danger attend the process of superheating steam, as conducted with this apparatus. Hydrogen gas alone is not explosive, but simply combustible; and assuming that it was liberated, as a result of the decomposition of superheated steam, its property of combustibility would not be manifested in the midst of the enormous quantity of aqueous vapour liberated with it and condensed around it. There could be no explosion, inasmuch as hydrogen, unless previously mixed with oxygen, does not explode; and oxygen is not liberated but actually fixed by this process. The vapour and gas, evolved under the form of superheated steam, tend to extinguish flame, and to prevent combustion from any other cause.

This superheating apparatus was then applied to the "Osprey," one of the boats on the Thames of the Watermen's Steam Packet Company, and the following results were obtained and confirmed by the company's engineer, as to its working during two months' trial in the early part of last year:—The saving in fuel effected by the use of the apparatus was 33 per cent., whilst the gain in revolutions of the engines was 11 per cent., with a decrease of pressure on the boiler. The cylinders remained as bright and in as good order as possible, although the temperature of the steam used was upwards of 440°; and the trunnion packing lasted the whole time. An objection was, however, raised on the part of the Board of Trade to these experiments in the "Osprey," with superheated steam being continued whilst carrying passengers, on account of the supposed danger involved. But the result of an investigation, made by Professor Faraday for the Board of Trade, was, that the apparatus was entirely safe; and that, as respected the decomposition of the steam by the heated iron of the tubes, and the separation of hydrogen, no new danger was incurred. Under extreme circumstances, the hydrogen which could be evolved would be very small in quantity; would not exert greater expansive force than the steam; would not with steam form an explosive mixture; would not be able to burn with explosion; and, probably, not at all, if it, with the steam, escaped through an aperture into the air, or even into the fireplace. Supposing the tubes were frequently heated overmuch, a slow oxidation of the iron might continue to go on within; this would be accompanied by a more rapid oxidation of the exterior iron surface, and the two causes would combine to the gradual injury of the tubes. But that would be an effect coming under the cognizance of the engineer, and would require repair in the ordinary way, and he did not consider even this action likely to occur in any serious degree; he examined a tube which had been used many months, which did not show this effect; and no harm or danger could happen to the public from such a cause.

This superheating apparatus was, consequently, applied to another of the boats of the same company, the "Swift;" and the result stated as to its working, up to the present time, is a saving in consumption of fuel of between 30 and 40 per cent. The apparatus is, consequently, being applied to all the remaining boats of the company, eleven in number. A trial of this superheating apparatus has also been made in H.M. steam-tug "Bustler;" and the mean result of 37 trials, with a pressure of 8½ lbs., and a temperature of 380° in the cylinders, was a saving of fuel of 25 per cent. with the use of superheated steam.

The superheating apparatus of Mr. Patridge, of H. M. Dockyard, Woolwich, as applied to marine boilers, consists of a cylinder, filled with tubes, placed vertically over the uptake, and resting on the steam-chest at the base of the chimney: the hot air and gases from the furnaces pass up through the tubes, and through the annular space round the cylinder, and the steam from the boiler enters the cylinder by radial pipes, and passes thence, by other pipes, to the engines, being deflected in its passage around the tubes by vertical plates: a thermometer is inserted in a cup of mercury in one of the pipes. This apparatus was applied to H. M. steam-ship "Dee," of 200 horse-power, and experiments were carried on over a period of many months, under the superintendence of Mr. Dinnen, and other gentlemen connected with the Admiralty; and the result obtained was an economy of fuel equal to from 20 to 25 per cent. Several vessels have now been fitted with this superheating apparatus, including the Royal Mail steam-ship "Tyne," of 400 horse-power, the Cunard Company's steam-ship "Persia," of 1000 horse-power, and the screw-engines of the "Great Eastern." Now, taking only the vessels already supplied with this superheating apparatus, amounting to about 5000 horse-power, and assuming that they actually steam four months out of the year, with a consumption, under ordinary circumstances, of 8 lbs. of coal per nominal horse-power per hour, the saving, if superheated steam be used, would amount to upwards of 10,000 tons of coal per annum; and the writer understands, that such is the enormous consumption by four of our large steam-ship companies, that, if superheated steam were used by all their ships, the saving would exceed £2000 per day throughout the year. This superheating apparatus works at a temperature ranging from 360° to 390°, and it is considered that the superheating tubes will wear out at least two sets of boilers.

It is evident that, in any arrangement, the proportion of superheating surface required will depend entirely upon where the apparatus is placed, and the temperature intended to be worked at. For a temperature up to 450°, this surface is found to vary from one-half square foot to five or six square feet per nominal horse-power: in Mr. Pilgrim's apparatus, about 0·50 to 0·55 square foot is sufficient for each nominal horse-power, at a temperature of 400°.

It thus appears that superheated steam may be safely used with an economy of fuel alone, varying from 20 to 35 per cent, and at the same time the feed and injection are both relatively diminished, the load upon the air-pump is diminished, and the number of revolutions of the engine increased in proportion. If attention is now turned to the causes of this great economy—bearing in mind that, by the application of heat, water assumes the form of steam under varying conditions, and that vessels filled with steam, free from water, may be heated to any degree without

greater danger than in heating common air—there are found to be three causes at least:—The first arises from the circumstance that each globule of steam carries with it a portion of water as it ascends, and this occurs whether the generating vessel be open to the atmosphere or closed under any pressure. There is also the tendency of the water surface, more or less, to combine and pass over with the steam in variable quantities in the form of minute unevaporated particles of water, which is a constant occurrence, probably arising from cohesive affinity. The first effect, therefore, of additional heat imparted to the wet steam is to set at liberty those portions of water held in suspension, and a consequent increase in the volume of steam takes place. Superheating then commences, the temperature of the steam becoming increased beyond that due to the pressure under which it was generated, and the volume of steam is further increased in proportion to the additional heat supplied. The third effect is that, by means of the increased temperature of the steam (as was clearly explained in the former paper referred to on the subject), the cylinder is prevented from becoming a partial condenser. These three causes combined produce the great economy resulting from the application of superheated steam.

In reference to the condensation of the superheated steam, it has been found by the writer that the water evaporated, the fuel consumed, and the injection water required, bear about the same ratio as when the steam is not superheated, the injection water being reduced in the same proportion as the feed water and the fuel. Hence it follows that no more heat has absolutely been imparted to the steam than it previously contained, however high its temperature be raised; the effect of the superheating appearing to be merely to increase the sensible, and diminish the latent heat, their sum still remaining a constant quantity.

Another advantage of superheated steam is, that the principal moving parts of the engine are less liable to accident; for with ordinary saturated steam the engine is literally (as described in the former paper) a mixed steam and water engine, and by the deposition of water, the cylinders, pistons, and rods are exposed to constant danger, which unfortunately is too often realised. Whilst a large steam-ship is at full speed, and before any precaution can be taken, the mischief is too often done; a piston is broken, and perhaps covers and rods also, and the engines are stopped at a time when the consequences may be very serious. This is not an exceptional case, but one of too common occurrence both at home and abroad; a sudden change in the atmospheric pressure, alteration of the ship's course, or a transition from bad fuel to good, and many other circumstances, cause a more rapid and sometimes instantaneous generation of steam, which carries more water with it into the cylinders than can be got rid of in time to prevent accident. These cases generally occur when the fires are forced, and it is difficult to get steam; the draught through the furnaces becoming suddenly influenced by one or other of the above changes. By the adoption of superheating, therefore, apart from the consideration that much of this water would be evaporated in its passage through the superheating apparatus, only ⅔rds of the fuel is now required that was before consumed in the same time, and consequently the necessity for hard firing will cease, and one great cause of priming be removed.

Mr. E. A. Cowper observed, that it was desirable to have full information as to the actual consumption of fuel and water before and after the superheating apparatus was applied, and as to the construction of the boilers employed, since the results depended greatly on whether the boilers were economical in fuel or of defective construction.

Mr. W. B. Johnson had seen a trial of superheated steam some time ago at Messrs. Hoyle's print works in Manchester; but no material economy of fuel was produced, and a great objection was felt to the superheating on account of its destructive influence on the cylinders and packing, and it was finally abandoned on that account, though the superheating apparatus had been put in at a considerable expense. The boilers were working with 50 lbs. steam, and were cylindrical with internal flues, and of a tolerably economical construction, ample in power and steam room; they were driving a pair of engines with 20-inch cylinders and 3 feet stroke; the steam was superheated by an additionnl boiler, round which the residue of heat from the principal boilers was conveyed.

Mr. C. Markham observed, that in any trials of superheating apparatus in connection with boilers, it was necessary to know the temperature in the chimney; and he believed the greatest portion of the advantage would be found to arise in many cases from the improvement of defective boilers which were previously wasting fuel; the superheating apparatus affording an additional area of heating surface which would increase the evaporative duty of the boiler. In steam-boats, particularly, a great heat escaped from the chimneys, showing the boilers to be very imperfect in absorbing the heat from the fuel consumed; and this loss would undoubtedly be diminished by the simple increase of heating surface given by the addition of the superheating apparatus. In the locomotives on the Midland Railway, of modern construction, the actual evaporation of water was found to be generally 7 lbs. per lb. of fuel; and with that evaporation the heat was frequently so entirely absorbed by the boiler, that a considerable proportion of the exhaust steam was condensed, and fell back from the top of the chimney; and it was only with heavy loads that there was sufficient heat drawn through into the chimney to carry the steam away to any distance. In these cases, he believed the application of the superheating apparatus would not give any advantage, nor in any other instance where it was applied to properly proportioned boilers

Mr. F. J. Bramwell thought there was an important circumstance to be considered, which distinctly showed the economy attendant upon superheating to be due to the principle of superheating: that the same total power was then obtained from a smaller quantity of water evaporated as well as of fuel consumed; for it appeared from the results of the trials that the water was reduced in a similar proportion to the fuel. This set aside the explanation of the saving being effected by waste heat previously lost, being absorbed by the superheating apparatus; and the economy that had been obtained could not therefore be attributed to improved application of the fuel in the boiler, but must be referred to some other cause arising from the action of the superheated steam.

Mr. C. W. Siemens had seen the trial of superheated steam that had been referred to at Messrs. Hoyle's works; and though the result had not proved favourable in that case; he thought that the failure might be fully accounted for by the imperfect way in which the experiment had been

tried: any single cases, however, of want of success could not be admitted, he considered, as permanent objections to the introduction of a system. There was much difficulty in making an experiment complete, and arriving at the correct result, and the value of the result depended upon the mode in which it had been conducted, and a perfect knowledge of all the circumstances involved. Amongst the circumstances to be considered in any experiments on superheated steam, were—the actual size and construction of the engine; whether the cylinders had steam-jackets or were well or imperfectly clothed; the degree of exposure and length of the steam-pipes; and the construction, form, and size of the boilers: the particulars of all these circumstances should be carefully noted in any experiments to determine the practical value of superheating the steam.

PROVISIONAL PROTECTIONS GRANTED.

1860.

[*Cases in which a Full Specification has been deposited.*]

1224. Hezekiah Conant, of Willimantic, Connecticut, U.S.A., for a new and useful improvement in mechanism for regulating the delivery or letting off of warp in looms for knitting or weaving.—[*Dated May 17th.*]

1232. Alfred Rogers Turner, of Malden, Massachusetts, U.S.A., for certain new and useful improvements in penholders.—[*Dated May 19th.*]

1241. Charles Joseph de Meyer, of Brussels, for improvements in pianofortes.—[*Dated May 21st.*]

1318. Eugène Dufossé, of Paris, for a system of skeleton or frame-work with continuous free air currents, applicable to the construction and improvement of seats of any description, mattresses, saddles, and upholstery generally, with a view to render them hygienic.—[*Dated May 29th.*]

1387. Charles Stevens, of Welbeck-street, for a new material for packing and other purposes, together with the apparatus used in the manufacture thereof,—being a communication.—[*Dated June 6th.*]

1410. George Kane, of Dublin, for the making or fabricating in wood, metal, or other suitable substances, bedsteads capable of being collapsed into a convenient size and form for transport as personal luggage, and to be styled "Kane's portable folding bedstead."—[*Dated June 8th.*]

[*Cases in which a Provisional Specification has been deposited.*]

342. George Augustus Huddart, of Brynkir, Caernarvonshire, for improvements in apparatus for obtaining motive power.—[*Dated February 8th.*]

691. Marc Antoine François Mennons, of Paris, for an improved arrangement of apparatus for working and controlling railway signal discs.—[*Dated March 15th.*]

828. Robert Lakin, of Ardwick, Manchester, and John Wain, of Manchester, for improvements in machines for spinning and doubling cotton and other fibrous substances.—[*Dated March 30th.*

910. Jules Ferdinand Hillel, of Mark-lane, for improvements in the apparatus and in the mode of treating Spanish grass and other fibrous materials, to be used in the manufacture of paper pulp.—[*Dated April 11th.*]

918. Hugh Smith, of Glasgow, for improvements in machinery for cutting wood.

919. Jasper Wheeler Rogers, of Robertstown, Kildare, for an improved

mode of draining peat-mosses, so as to render the peat obtained therefrom more useful as fuel; also improved means of and apparatus for drying and preparing the peat for fuel.

920. John Petrie, jun., of Rochdale, for improvements in machinery or apparatus for washing rags and other materials used in the manufacture of paper.

The above bear date April 12th.

921. Origen Vandenburgh, of Syracuse, New York State, for improvements in projectiles and appliances of projection; imparting great precision and great range of flight to projectiles forced through the air by gunpowder or other explosive compound; with facility for rapid discharge, and for discharging many projectiles simultaneously by one projecting appliance with the same advantages; giving increased area to the space covered by the destructive projectile matter, and light weight and small space to the appliance for projection.

922. John Platt, of Oldham, for improvements in mules for spinning and doubling.

923. Joseph Hill, of Ipswich, for improvements in wire screens.

924. Adam Bamlett, of Middleton Tyas, Yorkshire, for improvements in reaping and mowing machines, and in implements connected therewith.

925. John Wilson Hadwen, of Kebroyd Mills, Halifax, Yorkshire, for improvements in machinery or apparatus for combing or cleaning silk, cotton, wool, and other fibrous substances.

926. Abraham Mitchell, Joseph Mitchell, and Benjamin Emmerson, all of Bradford, Yorkshire, for improvements in looms for weaving.

927. James William Crossley, of Brighouse, Yorkshire, and John Crossley, of Halifax, for improvements in the construction of singe-plates; which improvements are also applicable to gas and other retorts.

928. William Burgess, of Newgate-street, for an improvement in mowing and reaping machines.

929. Thomas Fry, of Brooklyn, U.S.A., for improvement in castors for chairs and other like articles of furniture.

930. Thomas Edwards, of Birmingham, for improvements in obtaining motive power.

931. Louis Dubois, of Brussels, for improvements in printing rollers.

The above bear date April 13th.

932. Edward Joseph Hughes, of Manchester, for improvements in machinery or apparatus for sewing,—being a communication.

933. Jean Joseph Louis Brémond and Louis Zéphirin Thuilliez, of Paris, for improvements in spindles and other parts of spinning looms.

934. John Notman, of Nottingham, for improvements in sewing machines and in the apparatus connected therewith,—being a communication.

936. Marc Antoine François Mennons, of Paris, for an improved setting for lamp reflectors,—a communication.

937. Felix Fontenau, of Paris, for an apparatus for the preservation of life and property in cases of shipwreck.

938. Laurent Marie Boulard, of Paris, for an improved apparatus for preventing or destroying incrustations in steam-boilers.

939. Abraham Jones, of Manchester, for improvements in machinery or apparatus for making rivets, screw blanks, and other such articles.

940. John Petrie, jun., of Rochdale, for improvements in machinery or apparatus for drying warps for weaving.

941. Thomas Fisher and Edward Fisher, both of Wednesfield, for improvements in steam-engines.

942. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for improvements in rotating breech firearms,—being a communication.

943. Sir John Scott Lillie, of Pall Mall, for improvements in carriage ways.

944. Charles Edmund Wilson and Henry George Hacker, both of Monkwell-street, for improvements in machinery for the manufacture of chenille.

945. David Patridge, of Woolwich, for an improvement in or addition to apparatuses for superheating steam.

The above bear date April 14th.

946. Albert G. Richard, of New York, for the manufacture of improved machine belting and apparatus connected therewith,

947. Robert Brough and Richard Cox, both of Birmingham, for certain improvements in machinery for the manufacture of spikes, nails, pins, and rivets; and which said improvements are also applicable for partially forming or making chain links, holdfasts, staples, spouting hooks, and other such like articles formed of iron or other metal by forging, pressing, rolling, or drawing.

948. Charles Broglia and Pedro Pouchaut, both of Clerkenwell, for an improved apparatus to be employed in the roasting and preparation of coffee, cocoa, and chicory.

949. Thomas Burstall, of Southall, for improved machinery for manufacturing bricks from clay alone or mixed with other materials.

950. William Henry Muntz, of Millbrook, Hants, for improvements in the construction of floating piers.

951. Thomas Walker, of Birmingham, for improvements in apparatus for indicating the height of water in steam-boilers.

952. William Smith, of Kennington-row, Kennington-park, for improvements in paving or covering roads and other ways.

954. Desmond Gerald Fitzgerald, of Cambridge-street, and George Bate, of Great George-street, Westminster, for an improved method of igniting the charge in ordnance and other firearms.

955. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improved nippers for attaching blocks and tackles to ropes,—being a communication.

956. Albert Accarain, of Limbourg, Belgium, for improvements in treating ores of zinc, and in the apparatus employed therein.

957. William Clark, of Chancery-lane, for improvements in breech-loading firearms, and in projectiles; as also in apparatus for reducing ordinary guns to condition suitable for such improvements in firearms; which apparatus is also applicable for other purposes,—being a communication.

958. Thomas Turner, of Birmingham, for certain improvements in rifling, applicable to either breech or muzzle-loading firearms or ordnance.

The above bear date April 16th.

959. Charles Stevens, of Welbeck-street, for an improved steam mill,—being a communication.

960. Charles Vaughan, William James Vaughan, and Richard Vaughan, all of Birmingham, for improvements in the manufacture of hoes.

961. John Henry Johnson, of Lincoln's-inn-fields, for improvements in caloric engines,—being a communication.

962. John Patterson, of Beverley, for improvements in apparatus for churning; which apparatus is also applicable to the washing of clothes and other articles.

963. Gustav Hansemann, of Eupen, Prussia, for improvements in machinery for spinning yarns.

964. Henry Adcock, of the City-road, for improvements in puddling, balling, and mill furnaces.

965. William Carmont, and William Corbett, both of Clayton, near Manchester, for an improvement in casting steel tyres for wheels, which is also applicable to casting other articles of steel.

966. Samuel Cheetham, of Manchester, for certain improvements in cop tubes.

967. William Bridgett, of New Lenton, Nottinghamshire, for the regeneration and expansion of steam; applicable to steam-engines or for other purposes.

968. Charles De Iongh, of Lautenbach, near Guebwiller, France, for an improved mode of mounting the needles, points, and guides used in knitting and lace machinery.

969. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for an improvement in pianofortes,—being a communication.

The above bear date April 17th.

971. John Shaw and John Cook, both of Accrington, Lancashire, for improvements in looms.

972. Richard Archibald Brooman, of Fleet-street, for a method of, and apparatus, for, communicating to railway passengers the names of the

stations which the train successively approaches,—being a communication.

973. George Wilson Durham, of Size-lane, for improvements in machines for washing rags, pulp, and other fibrous materials.

975. Henry Payne, of St. James's-road, Old Kent-road, for improvements in lowering ship's boats.

976. Walter Davenport, of Bread-street, for improvements in roller window blinds.

977. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in pressing bonnets, bonnet frames, and similar articles,—being a communication.

978. Marcus Lafayette Byrn, of New York, for an improvement in cork-screws.

979. William Edward Newton, of the Office for Patents, 66, Chancery-lane, for improved means of illuminating buoys, finger, or direction posts, mile-stones, or other marks used at sea or on land, to guide or direct navigators or travellers, so as to render such buoys, posts, or marks visible at night,—being a communication.

The above bear date April 18th.

980. Bernard Lauth, of Manchester, for improvements in machinery or apparatus for straightening metal bars, rails, rods, tubes, plates, and other similar articles.

981. Samuel Wheatley and Alfred Milnes, both of Manchester, for an improved grinding strickle, for grinding the cards on the cylinders of carding engines.

982. Benjamin Harben and Richard Isaac Hathaway, both of Leadenhall-street, for a substitute for ordinary butter, especially adapted for the use of pastrycooks, biscuit bakers, and general culinary purposes.

983. Thomas Francis Edgeworth, of Liverpool, for improvements in apparatus for heating fluids.

984. James Willis, of Little Britain, for improvements in the manufacture of umbrellas and parasols; part of which improvements is applicable to walking sticks.

985. John Dale and Heinrich Caro, both of Manchester, for improvements in dyeing cotton yarns or threads and fabrics,—being a communication.

986. Josef Franz Mayr, of Vienna, for improvements in the obtaining of light, and in the apparatus employed therein,—being a communication.

The above bear date April 19th.

987. William Holland Kingston, of Bandon, Cork, Ireland, for a coke furnace for the distillation of coals,—being a communication.

988. Charles Felix Sebille, of Nantes, for a non-metallic composition to be used in the manufacture of water, gas, and other pipes or conduits, and machinery or apparatus to be used in such manufacture.

989. John Dyer, Jun., of Islington, for a new or improved process for the ornamentation of certain articles of bed-room furniture.

990. Richard Roberts, of Manchester, for improvements in punching machines.

991. Thomas Geast Dawes, of Wolverhampton, for improvements in working hammers by compressed air.

992. William Collinson Ridings, of Middleton, Lancashire, for improvements in machinery or apparatus for reading and repeating designs for perforating cards or paper for jacquard weaving.

993. Thomas Boyle, of Woburn-buildings, Euston-square, for producing multiplied and many-colored reflections of light from one focus of incidence.

994. Hugh Adams Silver and James Barwick, both of Silvertown, Essex, for improvements in moulding india-rubber and other like gums in cells for galvanic batteries, and in insulators for telegraph wires.

995. William Lukyn the elder, of Nottingham, for a method of attaching artificial or natural teeth on expanded or contracted frames.

996. Abraham Denny and Edward Maynard Denny, both of Waterford, Ireland, for a revolving feed apparatus, as applied to singeing pigs, to facilitate the introduction of the carcases into the singeing apparatus.

997. James Walker, of Walsall, for improvements in railway sleepers.

The above bear date April 20th.

998. William Clark, of Chancery-lane, for improvements in enclosing or covering opium and other matters,—being a communication.
999. Tom Abercrombie Hedley, of Banbury, and George Henry Carne Hedley, of St. Neot's, for improvements in valves and apparatus for regulating the flow of fluids.
1000. William Butlin, of Northampton, for improvements in apparatus for super-heating the steam and heating the feed water in steam-boilers.
1001. William Macnab, of Greenock, N.B., for improvements in, and connected with, marine and other steam-engines.
1002. Joseph Lewtas, of Manchester, for an improvement applicable to outside sun blinds.
1003. Edward Peyton and William Fothergill Batho, both of Birmingham, for improvements in the manufacture of metallic bedsteads.
1004. William Buckwell, of East Greenwich, for improvements in the manufacture of slabs, plates, and panels for the transmission of light.
1005. William Buckwell, of Phœnix Stone Works, East Greenwich, for an improved mode of operating recording or printing telegraphic apparatus.
1006. James Walker, of Walsall, for improvements in railway points or switches, and also in the keys for securing the rails in the chairs of railways.
1007. John Harvey, of Circus-street, Marylebone-road, for improvements in safety-valves.

The above bear date April 21st.

1008. John Parkinson, of Bury, Lancashire, for improvements in machinery for separating small particles of iron or steel from brass and other metals or materials.
1009. Florimond Datichy, of Paris, for improvements in apparatus for utilizing the waste steam of steam-engines.
1010. Jules Alphonse Philippe, of Paris, for a new process and apparatus for bleaching fabrics and substances that can be bleached, such as thread, textile plants, and paper pulp.
1011. John Dangerfield, of Tipton, for improvements in apparatus or machinery for the manufacture of chains.
1012. Richard Archibald Brooman, of Fleet-street, for improvements in milk cans,—being a communication.
1013. Richard Archibald Brooman, of Fleet-street, for improvements in buoys,—being a communication.
1014. George Henry Birkbeck, of Southampton-buildings, for improvements in machinery or apparatus for printing woven or other fabrics or tissues,—being a communication.

The above bear date April 23rd.

1015. Alexander Ritchie, of Glasgow, for an improved system of book-keeping.
1017. Edward Hillam, of Baildon, near Leeds, and Richard Renner Wilson, of Halifax, for improvements in apparatus employed in finishing textile fabrics.
1018. Louis Oriard, of Cheviré Lerouge, France, for improvements in breech-loading firearms, and in their cartridges.
1019. Edward Wilkins, of Bath-terrace, Camberwell New-road, for improvements in the manufacture of boots, shoes, and goloshes.
1021. James Brodie, of Bow, of Fife, for improvements upon latches and bolts employed in locks and other fastenings.
1023. Francis Wrightson, of Birmingham, for improvements in applying certain waste or refuse products to the purification of coal gas, and in utilizing compounds obtained in purifying coal gas.
1024. John Stafford, of Oakerthorpe, Derbyshire, and Benjamin Stafford, of New Lenton, Nottinghamshire, for an improved method of applying heated air or steam, for drying stoves, or boiling liquids, or for other purposes.
1025. Charles Edmund Albrecht, of Radnor-place, Hyde-park, for an improved apparatus for sifting or screening.
1026. John Wallace Fuller, of Her Majesty's Dock-yard, Deptford, for an improved method of fitting dead-eye chain and preventer plates to ships.
1027. William Clark, of Chancery-lane, for improvements in the manu-

facture of ammonia,—being a communication.

1028. John William Ford, of Change-alley, Cornhill, for improvements in the driving gear of pumps,—being a communication.

1029. Henry John Morgan, of Gloucester-terrace, Hyde-park, for improvements in rockets.

1030. Alfred Vincent Newton, of the Office for Patents, 66, Chancery-lane, for an improved construction of ship's stove,—being a communication.

1031. Robert Atkinson, of Southampton-court, Tottenham-court-road, for an apparatus to give warning to the inmates of a house or apartment, of the attempted entry of thieves or burglars; which may be called a burglar and thief detector.

The above bear date April 24th.

1032. James Kennedy, of Church-street, Westminster, for improvements in the construction of sliding sash frames or windows.

1033. Theodoor Augustin Claeys, of Ostend, for improved machinery for the manufacture of corks, bungs, and shives.

1034. Victor Lardin, of Montigny-le-Roi, Haute Marne, France, for improvements in water pumps.

1035. Carlo Minasi, of St. James's-terrace, Kentish-town-road, for improvements in music stools and other seats, and in stands for supporting music books and other articles.

1036. Asahel Knowlton Eaton, of New York, for a mode of manufacturing steel.

1037. George Jubilee Parker, of Church-street, Stoke Newington, for improvements in the means or apparatus for raising water and other fluids.

1038. James Mason, the younger, of Preston, for improvements in looms for weaving.

1039. Silas Nicholls, of Buckland-street, New North-road, and Henry Leonard, of Arlington-street, Islington, for an improved fire-guard or protector.

1040. Xavier Tarte and William Toovey, both of Brussels, for improvements in the construction of floorings and roofings, and other parts of buildings and other structures, which improvements are also applicable to the construction of bridges and other works.

1041. Robert Seager, of Ipswich, for improvements in the manufacture of boots and shoes.

1042. John George West, of Fleet-street, for an improvement in compasses.

1043. Jules Albert Hartmann, of Mulhouse, France, for the extraction of a certain coloring matter from rags and other waste vegetable textile fabrics containing the same.

The above bear date April 25th.

1045. John Clark and William Cross, both of Glasgow, for improvements in power-looms for weaving checks.

1046. Andrew Robertson, of Neilston, Renfrewshire, N. B., for improvements in steam-boiler furnaces.

1047. Ebenezer Waugh Fernie, of Old Jewry-chambers, for improvements in open fire-places and in their flues.

1048. William Bate, of Wolverhampton, for improvements in attaching knobs to spindles of door locks and latches.

1049. James Wright, of Bridge-street, Blackfriars, for a new mode of preventing incrustation in boilers using sea or calcareous waters,—being a communication.

1050. William Maltby, of De Crespigny-park, Camberwell, for improvements in the treatment of rice, in order to manufacture starch, starch-gum, and gums.

1051. George Francis Train, of Liverpool, for an improved system of railway or tramway to be used with horses or other power, and passenger carriages for the same.

1052. William Buckwell, of East Greenwich, for improvements in the construction of iron roofs and bridges, and in apparatus to be used in their erection.

1053. John Henry Johnson, of Lincoln's-inn-fields, for improvements in portable bedsteads and in the mattresses to be used therewith,—being a communication.

1054. Richard Archibald Brooman, of Fleet-street, for improvements in lamps,—being a communication.

1055. William Clark, of Chancery-lane, for improvements in boring bits,—being a communication.

1056. William James Harvey, of Exeter, for improvements in the manufacture of breech-loading firearms; also in cartridges applicable for the same.

The above bear date April 26th.

1057. William Northen, of Vauxhall-walk, Lambeth, for an improvement in the internal construction of kilns used for the burning of stoneware or earthenware of every description.

1058. James White, George White, and John White, all of Hulme, Manchester, for an improvement or improvements in machinery for pressing and cutting tobacco or other substances.

1059. Léopold D'Aubréville, of Paris, for improvements in the manufacture of metallic boxes or vessels used to contain preserved alimentary provisions or other substances, and in the apparatuses and machinery employed therein,—being a communication.

1060. William Bowers Taylor, of Ballymena, Antrim, Ireland, for certain improvements in looms for weaving.

1061. Peter Thorn, of Cumberland-street, Pimlico, for improvements in signals applicable to domestic and other purposes.

1062. George Ager, of Aylsham, Norfolk, for improvements in means or apparatus for breaking up or opening land.

1063. John Nichols, of Pendleton, for improvements in looms for weaving.

1064. James Bullough, of New Accrington, for improvements in looms for weaving.

1065. Franz Thonet, of Vienna, for improvements in the construction of wooden wheels.

1066. Josiah Lorkin, of Brighton, for an improvement in the manufacture of gunpowder,—being a communication.

1067. Henry Shepherd Rosser, of Kensington, for an improved sole to be worn in boots and shoes.

1068. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in ordnance and firearms,—being a communication.

1069. Louis Alexandre Floire, of Paris, for an improved electric break.

1070. Thomas Sibley, of Ashton-under-Lyne, for improvements in looms for weaving.

1071. George Withers, of West Bromwich, for certain improvements in fireproof wrought-iron safes, chests, or closets, in locks for the same and other purposes, and for certain apparatus to be used in connection with the same.

1072. John Vickers Scarborough and Daniel McMillan, both of Belfast, for improvements in the manufacture of boots, shoes, and clogs.

1073. William Low, of Edinburgh, for improvements in machinery or apparatus for rubbing or finishing printing types.

The above bear date April 27th.

1074. John Sidebottom, of Broadbottom, Cheshire, for certain improvements in looms for weaving.

1075. Thomas Molineux, of Manchester, for improvements in pianofortes.

1076. Joseph Green, of Leeds, for an improved cutting and sawing machine.

1077. Andrew Linmere Dowie, of Glasgow, for improvements in gas-burners, and in pressure-regulating apparatus for the same.

1078. The Right Honorable Richard, Lord Berwick, of Attingham-hall, Salop, for improvements in rifling firearms.

1079. William Henry Samson, of St. Brelade's Bay, Jersey, for a machine or apparatus for the cultivation of the soil.

1080. Henry James Barr, of Bombay, for improvements in working railway signals, and in apparatus employed therein.

1081. Edwin Southorn, of Broseley, Salop, for an improvement in, or addition to, tobacco pipes, and improvements in the manufacture and ornamentation of tobacco pipes.

1082. John Grantham, of Nicholas-lane, for improvements in apparatus for feeding furnaces with coals.

1083. Henry Rawson, of Leicester, for improvements in machinery for combing wool and other fibres.

1084. John Grantham, of Nicholas-lane, for improvements in slips for raising ships and vessels.

The above bear date April 28th.

1085. Georges Masure, of Brussels,

for improvements in the construction of railway crossings.

1086. William Gossage, of Widnes, Lancashire, for improvements in obtaining products by means of distillation and condensation, or by one of such means, from oily, fatty, resinous, and bituminous substances.

1087. Joseph Pierre Gillard, of Alfred-road, Upper Holloway, for improvements in apparatus for manufacturing gas for lighting and heating, and for obtaining motive power.

1088. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in apparatus for working the valves of steam-engines,—being a communication.

1089. Henry Thomas Green, of Moreton, and Samuel Barlow Wright, of Parkfields, both in Staffordshire, for improvements in machinery for the manufacture of plain and ornamented bricks, slabs, tiles, and quarries.

1091. Edward Thomas Hughes, of Chancery-lane, for improvements in jointing or connecting rails of railways,—being a communication.

1092. John Lansley, of Brown Candover, Hants, for improvements in harrows.

1093. James Henry Bennett, of Leith, for combined direct-action balance safety-valves.

The above bear date April 30th.

1094. Alfred Upward, of the Gas Works, Brick-lane, for improvements in apparatus employed in boring and tapping gas and water mains, and in fitting service pipes thereto.

1095. Francis Preston, of Manchester, for certain improvements in breech-loading firearms and projectiles; also in the machinery employed in manufacturing projectiles.

1096. James Taylor, of Artillery-lane, Bishopsgate-street, for improved apparatus for preventing a downward draught of air in chimneys, and for causing the smoke to ascend; applicable also for the purposes of ventilation.

1097. John Henry Walsh, of Kensington, for an improvement in breech-loading firearms, and in rests to be employed therewith, which rests are also applicable to other descriptions of firearms.

1098. George Bower, of Droylesden, for certain improvements in metallic pistons.

1099. William Anderson, of Glasgow, for improvements in the manufacture or production of nitrate of potash and soda, and in the application and use of certain products of such manufacture in the manufacture of soap.

1100. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved apparatus for lifting vessels out of water,—being a communication.

The above bear date May 1st.

1101. Alexander Bain, of Rahere-street, Goswell-road, for improvements in the means of obtaining copies of letters and other writings or documents.

1102. John Brown, of Manchester, for improvements in the spouts or tubes of lubricating cans.

1104. William Edward Gedge, of Wellington-street, for an improved apparatus for obtaining pneumatic power,—being a communication.

1105. Benjamin Browne, of King William-street, for a self-heating ironing apparatus,—being a communication.

1106. William Sterling Jackson, of Milton-street, Dorset-square, for improvements in the manufacture of soap.

1107. Mathieu Bonnor, of Eurville, France, for improvements in machinery for rolling bar iron, steel, and other metals or malleable matters.

1108. James Gardner, of Eversholt-street, for improvements in metallic bedsteads.

1109. Thomas Silver, of Philadelphia, U.S.A., for improvements in the machinery for, and method of, driving or communicating motion to a ship's propeller.

The above bear date May 2nd.

1110. Adam Dixon, of Birmingham, for improvements in screw stocks and dies.

1111. James Brickhill, of St. Leonard's-road, Bromley, and James Noble, of York-street East, Stepney, for improvements in screw propellers.

1112. Alphonse René le Mire Normandy, of King's-road, Clapham.

park, for improvements in the construction of steam-boilers.

1113. George Elgar Toomer, of Hosden House, Ash, Sandwich, for an improved construction of plough.

1114. Michael Henry, of Fleet-street, for improvements in the mode of, and apparatus for, propelling, turning, and changing the direction of ships, balloons, and other bodies,—being a communication.

1115. George Davies, of Serle-street, Lincoln's-inn, for improvements in the manufacture of boots, shoes, and other coverings for the feet; and in apparatus connected with such manufacture,—being a communication.

The above bear date May 3rd.

1116. Henry Reid, of Lee, Kent, for improvements in hoops for hooping casks, barrels, and such like articles.

1118. Timothy Railton, of Manchester, for improvements in the apparatus employed in the manufacture of cap or bonnet fronts.

1119. Thomas Heatley, of High Hatton, Shawbury, Salop, and William Paddock, of Shrewsbury, for improvements in threshing machines.

The above bear date May 4th.

1120. Charles Stevens, of Welbeck-street, for an improved means and apparatus for transporting and preserving live fish, and keeping water fresh for a long period,—being a communication.

1122. Edwin Hardon, of Stockport, and Lee Lee, of Manchester, for certain improvements in finishing woven fabrics.

1123. Ellison Smith, of Keighley, Yorkshire, for an improvement in machinery for preparing wool, cotton, flax, and other fibrous materials.

1124. Joseph Grimond, of Dundee, for improvements in weaving.

1125. William Denley, of Exeter-place, Chelsea, and John Perrin, of Walton-street, Chelsea, for improvements in fire-places and flues.

1126. William Hunt, of Tipton, Staffordshire, for improvements in the manufacture of carbonate of soda, and in apparatus to be employed in the said manufacture; also in utilizing waste products obtained in the said manufacture.

1127. Abraham Tweedale and John Tweedale, both of Healey Hall, near Rochdale, and Samuel Taylor, of Rochdale, for improvements in temples for looms, and in indicating the number of picks made in such machinery for a given length of cloth.

The above bear date May 5th.

1128. James Dalziel Dougall, of Glasgow, for improvements in breech-loading fire-arms.

1129. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the manufacture of glass,—being a communication.

1130. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improvement in rotary planes,—being a communication.

1131. Martyn John Roberts, of Crickhowell, Brecon, for improvements in breech-loading firearms.

1132. Jacob Albert Eisenstuck, of Chemnitz, Saxony, for improvements in knitting machinery.

1133. Josiah Harris, of City Bank Chambers, Threadneedle-street, for improvements in the manufacture of coke and charcoal from lignite, and obtaining products therefrom.

1134. John Henry Johnson, of Lincoln's-inn-fields, for improvements in pipe couplings,—being a communication.

The above bear date May 7th.

1135. John Corbett, of Stoke Works, near Bromsgrove, for improvements in evaporating pans for the manufacture of salt.

1137. William Robert Barker and Julius Schweitzer, of Chapel-street, Belgrave-square, for improvements in the manufacture of artificial mineral chalybeate water.

1138. Walter Evans, of Derby, for improvements in machinery for polishing yarns and threads.

1139. Daniel Sutton, of Banbury, for improvements in the construction of rollers for rolling and crushing land.

1140. Thomas Murray Gladstone, of London-street, City, for an improvement in the construction and form of anchors.

The above bear date May 8th.

1141. George Scott, of Greenwich, for improvements in furnace or grate bars.

1142. Henry Kemp, of St. Marylebone, for improvements in preserving wood, leather, iron, and other substances.

1143. Robert Geoghegan, of Dublin, for improvements in machinery or apparatus for expressing liquids from various substances.

1144. Ellis Butterworth, of Spotland, near Rochdale, for improvements in machinery for preparing and spinning cotton and other fibrous substances.

1145. Jean Baptiste Joseph de Buyer, of Rupt, near Scey-sur-Saône, for a new system of cast-iron cart wheels.

1146. James Reid, of University-street, for improvements in electric telegraph conductors.

1147. Archibald G. Shaver, of New Haven, U.S.A., for an eraser and pencil sharpener.

1148. John Martyn Fisher, of Taunton, for improvements in chimney-tops or cowls.

1149. Richard Archibald Brooman, of Fleet-street, for improvements in horse mills,—being a communication.

1150. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the manufacture of threads and yarns, and in the preparation of fibrous materials for such manufacture,—being a communication.

1151. William Beckett Johnson, of Manchester, for improvements in steam-engines and boilers, and apparatus connected therewith.

1152. James Howard, of Bedford, and John Lilley, of Astwood, Buckinghamshire, for an improved construction of horse hoe.

The above bear date May 9th.

1153. William Edward Gedge, of Wellington-street, for improvements in breech-loading firearms,—being a communication.

1154. Henry Wildsmith, Joshua Carter, and James Joshua Carter, all of Batley, Yorkshire, for improvements in extracting wool or other animal fibres from combinations of wool and cotton, or mixtures of other animal and vegetable fibrous substances or fabrics; and in the machinery or apparatus employed therein.

1155. Richard Boyman Boyman, of Stockwell, for improvements in applying steam or other expansive prime movers, by action and reaction, for rotary motion and propulsion, and in the machinery for the purpose.

1156. Frederick Edwards, of Great Marlborough-street, for improvements in chimney-bars or plates.

1157. Alexander Wilson, of Edinburgh, for improvements in the construction of railway carriages, waggons, and trucks; which improvements are also applicable to vehicles for common roads.

The above bear date May 10th.

1158. George Price, of Wolverhampton, for improvements in locks.

1159. Frederick Bernhard Doering, of Ebury-street, for apparatus for governing and regulating the speed of marine engines.

1160. John Macintosh, of North Bank, Regent's-park, for improvements in artificial gums, and setting and stopping teeth.

1161. James Uttley and Joseph Bray, both of Staleybridge, for improvements in machinery or apparatus for spinning cotton, wool, silk, flax, and other fibrous materials.

1163. Samuel Ridge, of Hovileybridge, near Hyde, Cheshire, for improvements in the process of ageing printed woven fabrics.

1164. John Grantham, of Nicholas-lane, William Sinnock, of Warkworth-terrace, and Lazarus Simon Magnus, of Adelaide-place, for improvements in the manufacture of wire-rope, and in machinery for that purpose, with special application to the manufacture of telegraph cables.

1165. Richard Archibald Brooman, of Fleet-street, for improvements in driving or propelling railway rolling stock,—being a communication.

1166. Andrew Robertson, of Neilston, Renfrewshire, N.B., for improvements in preventing smoke.

1167. Thomas Henry Morrell, of Leyland, and Henry Charnley, of Preston, both in Lancashire, for an improved machine for making bricks and tiles, and other articles, from plastic materials.

1168. Thomas Wilson, of Birmingham, for improvements in projec-

tiles and cartridges for firearms and ordnance.

1169. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in electric conductors for telegraphic purposes, and in the apparatus for, and mode or means of, transmitting signals between distant places,—being a communication.

1170. Joseph Owen, of Sheffield, and George Veitch, of Birmingham, for improvements in the construction of the bottoms of bedsteads, mattresses, couches, sofas, seats, chairs, and other articles for sitting or reclining upon, in order to render them more springy or elastic.

1171. William Clark, of Chancery-lane, for improvements in the manufacture of cyanides of barium and strontium,—being a communication.

1172. William Brown and Charles Neale May, both of Devizes, for improvements in brick-making machines.

1173. Thomas Nasmyth, of Brussels, for improvements in taps and valves,—being a communication.

1174. Charles Stevens, of Welbeck-street, for an improved machine for raising water,—being a communication.

The above bear date May 11th.

1175. William Basford, of Burslem, for improvements in the mode of constructing brick walls, and in the mode of forming and ornamenting the materials to be used for the same.

1176. Robert Young, of Glasgow, for improvements in apparatus for cleaning grain.

1177. William Senior, of Wakefield, Yorkshire, and William Statter, of the same place, for improvements in purifying gas, and thereby obtaining a useful product.

1178. John Chatterton, of Highbury-terrace, and Willoughby Smith, of Pownall-road, Dalston, for improvements in electric telegraph conductors.

1179. Silas C. Salisbury, of Essex-street, for an improved construction of metallic fencing,—being a communication.

The above bear date May 12th.

1181. Henry Louis Lilley, of Stand-lane, Lancashire, for improvements in machinery or apparatus for scraping starch.

1182. Edward Lord, of Todmorden, Yorkshire, for certain improvements in machinery for opening, blowing, and cleaning cotton and other fibrous materials.

1183. William Henry Muntz, and Henry King, both of Millbrook, Hants, for certain improvements in marine steam-engines; part of which is applicable also to ships' pumps.

1184. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improvement in iron pavements, — being a communication.

1185. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the construction of metallic barometers,—being a communication.

1186. Thomas Howarth, of Preston, Lancashire, for improvements in machinery or apparatus applicable to looms for weaving, and the tools employed therein.

1187. Edward Trygarn Jones, of Greenwich, and Henry Owen, of Llantrisant, North Wales, for improvements in roasting jacks.

The above bear date May 14th.

1188. Robert Read, of Leicester, for improvements in the process of waterproofing fabrics for garments, so as to allow perspiration to pass through the same.

1189. Charles Stevens, of Welbeck-street, for an improved centrifugal turbine,—being a communication.

1190. Alphonse Sax, of Paris, for a new mode of obtaining motive power by the effect of weights and springs, or by springs only, in combination with proper connecting parts.

1191. Bernhard Samuelson, of Banbury, Oxon, for improvements in reaping and mowing machines.

1192. Samuel Smithard, of Nottingham, and Henry Wheatcroft, of Fore-street, for improvements in the construction of machines for uniting portions of lace, blond, edging, net, and other fabrics, usually called "running on" machines.

1193. George Harman Barth, of Piccadilly, for improvements in processes

for aerating or super-saturating water and other fluids with oxygen, or compounds of oxygen, or other gas or gases.

1194. Bartlett Hooper, of King William-street, London Bridge, for improvements in the manufacture of a paper suitable for preventing forgery.

1195. James Higgins and Thomas Schofield Whitworth, both of Salford, Lancashire, for improvements in machinery or apparatus for preparing and spinning cotton and other fibrous materials.

1196. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in valves and valve gear, for the induction and eduction of steam to and from the cylinders of steam-engines, part of which is applicable to other purposes,—being a communication.

1197. Silas C. Salisbury, of Essex-street, for an improved mode of, and apparatus for, churning butter,—being a communication.

1198. Julien Denis, of Queenhithe, for improvements in the preparation of vegetable matters, as a pulp, for the manufacture of paper,—being a communication.

1199. Stephen Norwood Larkins, of Dover, for improved bathing apparatus.

1200. Reuben Jacob Jordan, of Berners-street, Oxford-street, for improvements in pills.

The above bear date May 15th.

1202. Cortland Herbert Simpson, of Bexhill, Sussex, for improvements in propelling vessels through the water, and apparatus connected therewith.

1203. John Grant, of Glen Grant, Moray, for improvements in breakwaters.

1204. Peter Chrimes, of Manchester, for improvements in stoppering bottles, jars, and other like vessels.

1205. Joseph Ambler, of Little Horton, Yorkshire, for a new kind of cloth or woven fabric.

1206. Charles Cowper, of Southampton-buildings, for the manufacture and application to fibres and fabrics of a new blue colour, and compounds of the same with other colours,—being a communication.

1207. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved mode of treating oils for the production of gas and volatile oils,—being a communication.

1208. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in locks for safes, doors, and other purposes,—being a communication.

1209. Claude Marie Guillemin, of Paris, for improvements in submarine electric telegraphs.

The above bear date May 16th.

1210. William Krutzsch, of Chamber-street, Goodman's-fields, for improvements in mortars.

1211. Caspar Loewenstein, of Crutched-friars, for improvements in arrangements for paying out submarine cables.

1212. Marc Antoine François Mennons, of Paris, for an improved handle or holdfast for files, chisels, and similar tools,—being a communication.

1213. Marc Antoine François Mennons, of Paris, for improvements in the cylinders and pistons of steam and other engines or machines propelled by aeriform fluids,—being a communication.

1215. Marc Antoine François Mennons, of Paris, for an improved railway brake,—being a communication.

1216. Joseph Nicholson, of Hensingham, Whitehaven, for improvements in reaping machines.

1217. George Davies, of Serle-street, for a system of chromato-topo-chronographic charts, intended to facilitate the study of universal history and chronology,—being a communication.

1218. Andrew Robertson, of Neilston, Renfrewshire, and Alexander Ritchie, of Glasgow, for improvements in steam-boiler and other furnaces, and in the prevention of smoke.

1219. Silas C. Salisbury, of Essex-street, for improvements in machinery and apparatus to be employed in weaving.

1220. James Cole, of Coventry, for improvements in looms for weaving.

1221. Alfred Buckingham Ibbotson, of Sheffield, for improvements in vices; part of which improvements is applicable to screw wrenches, spanners,

turning lathes, and other tools and machines,—being a communication.
1222. Richard Archibald Brooman, of Fleet-street, for an improved mowing machine,—being a communication.
1223. Samuel Holdsworth, John Henderson, William Henderson, and Thomas Bagley, all of Durham, for improvements in looms for weaving.
1225. John Dearman Dunnicliff and Stephen Bates, both of Nottingham, for improvements in bobbin-net or twist-lace machines.
1226. William Geeves, of New Wharf-road, Battle Bridge, for improvements in saw mills.
1227. Nathaniel Clayton and Joseph Shuttleworth, both of Lincoln, for improvements in portable and traction engines.

The above bear date May 17th.

1228. Hilary Nicholas Nissen, of Mark-lane, for improvements in the preparation of paper, in order to prevent the extraction or alteration of writings thereon without detection.
1229. Samuel Fielden and Abraham Fielden, both of Todmorden, Lancashire, for improvements in self-acting mules for spinning.
1230. James Ferguson, of Paisley, for improvements in and connected with looms for weaving.
1231. Charles Stevens, of Welbeck-street, for improvements in striking clocks,—being a communication.
1233. William Ambler, of Keighley, Yorkshire, for improvements in means or apparatus to facilitate the consumption of smoke in furnaces.
1234. Samuel Davey, of Hatton Garden, for improvements in fastenings for attaching buttons, studs, brooches, or other ornaments and fastenings, to articles of dress, and for other uses.
1235. Josiah Lees, of Birmingham, for improvements in the manufacture of swivels, hooks, and rings, for attaching and securing watches, chains, or jewellery; parts of which improvements are applicable to key-rings, earrings, and other similar articles.
1236. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved liquid preparation of tobacco,—being a communication.
1237. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in looms for weaving carpets and other looped and pile fabrics,—being a communication.
1238. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in printing blocks for printing fibrous and textile fabrics,—being a communication.
1239. John Longmaid, of Inver, Galway, Ireland, for improvements in treating iron pyrites and other ores containing copper, silver, and tin, or either of them, and sulphur.
1240. Christopher Binks, of Parliament-street, and John Macqueen, of Old Jewry, for improvements in treating certain manganese compounds, for obtaining oxides of manganese and other products therefrom.

The above bear date May 19th.

1243. Thomas Blakeley, of Liverpool, for improvements in rotatory engines.
1245. Thomas William Teulon, of Euston-road, for improvements in chimney tops.
1246. William Barker the younger, of Huyton Brewery, near Liverpool, for an improved apparatus for regulating the temperature of ale, beer, porter, and other liquids during the process of fermentation.
1247. James Craig, of Paisley, for improvements in cropping and clipping machines, for the treatment of woven fabrics.
1248. Samuel Rodgers Samuels, of Nottingham, for improvements in machinery used in weaving.
1249. George Nimmo, of Glasgow, for improvements in the manufacture of iron.
1250. Valentine Baker, of Hounslow, for improvements in breech-loading and other ordnance.
1251. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the mode of, and apparatus for, winding clocks or other time-keepers,—being a communication.
1252. Alfred Holland, of Queen-street, Oxford-street, for an improvement in the construction of roller blinds.

The above bear date May 21st.

1253. George Moulton, of Manchester,

for improvements in machinery for transferring to, or tracing upon, printing rollers or cylinders copies of designs or patterns intended to be etched or engraved thereon.

1254. Joseph William Wilson, of Buckingham-street, Strand, and John Harris, of Gresham-street, City, for a new method of constructing and forming boxes or cases for containing and enclosing different articles, more especially during their transmission by post or other conveyance.

1255. John Green, of Newtown, Worcestershire, for improvements in the construction of ploughs, cultivators, and similar agricultural implements.

1256. Samuel Hood, of Upper Thames-street, for the manufacture of improved wrought-iron sash-frames and casements, and all kinds of wrought-iron framing.

1257. James Hinks, of Birmingham, for improvements in lamps for burning petroline and other liquid hydrocarbons, and in supports for the said lamps.

1258. Bewicke Blackburn, of Clapham-common, and Henry Carr, of Victoria-street, Westminster, for improvements in railway axle-boxes and axles.

1259. John Marland, of Southport, Lancashire, for improvements in preparing for and in warping and sizing woollen and worsted and other yarns and threads.

1260. William Thomas Shaw, of Bunhill-row, for improvements in thaumatropes or phenakistoscopes.

1261. John Bottomley, of Laister Dyke, Yorkshire, for improvements in means or apparatus employed in spinning wool and other fibrous substances.

1262. James Hickisson, of Maria-street, Kingsland-road, for improvements in means or apparatus for ascertaining the character of metals, particularly applicable to the detection of counterfeit coin.

1263. James Goldie, of Glasgow, for improvements in furnaces, and in the consumption or prevention of smoke.

1264. John Paton, of Glasgow, for improvements in machinery or apparatus for winding, lifting, and boring for mining purposes.

1265. John Henry Johnson, of Lincoln's-inn-fields, for improvements in machinery or apparatus employed in spinning,—being a communication.

1266. William Clissold, of Dudbridge, for an improvement in the manufacture of driving belts.

1267. William Clissold, of Dudbridge, Gloucestershire, for an improvement in the construction of gearing wheels.

1268. Michael Henry, of Fleet-street, for an improved mode of suspending gas-lights,—being a communication.

The above bear date May 22nd.

1269. George Paul, of Glasgow, for improvements in machinery for winding yarn or thread.

1270. Thomas Cope, of Liverpool, for improvements in the treatment and preparation of tobacco.

1271. William Hickling Burnett, of Margaret-street, for improvements in electric telegraphs, and in apparatuses employed therewith; a part of which improvements is applicable to the winding of clockwork.

1272. Michael Cavanagh, of Kensington, for improvements in lock spindles.

1273. Pierre Ernest Chevalier, of Paris, for an improved table stand, for the support of glasses and other articles.

1274. George Bartholomew, of Linlithgow, N.B., for improvements in shoes for the feet of horses and other animals.

1275. Robert Hanham Collyer, of Alpha-road, Regent's-park, for improvements in the manufacture of tubes and other vessels and other articles, and in the machinery and apparatus connected therewith.

1276. Charles Fanshawe Atkinson, of Sheffield, for certain improvements in the manufacture of chains.

1277. John Summerscales and Jubal Sagar, both of Keighley, Yorkshire, for improvements in washing, wringing, mangling, squeezing, and crushing machines.

1278. Thomas Heppleston, of Manchester, for an improvement or improvements in breech-loading fire-arms, and in projectiles to be used therewith.

1279. William Howard, of Great Russell-street, for an improved window blind.

1280. Denis Mulkay, of Brussels, for improvements in springs for supporting or distending ladies' dresses.

1281. William Henry Barker, of Kingston-upon-Hull, for improvements in moulds for candles.

1282. François Joseph Edouard Duclos de Boussois, of Paris, for improvements in the manufacture of tubes, hollow axles, shafts, gun-barrels, masts, and other tubular metal articles.

1283. François Joseph Edouard Duclos de Boussois, of Paris, for improvements in the treatment of bituminous rocks, for the extraction of bitumen therefrom, and in the application of the residuum to various useful purposes.

The above bear date May 23rd.

1284. John Sharp, of Bradford, Yorkshire, for improvements in looms for weaving.

1285. Richard Husband Heighway, of the Strand, for an improved cooking apparatus.

1286. Thomas Johnson, of Plumstead, for improvements in machines for washing bottles and jars.

1287. Robert Calvert Clapham, of Walker, Northumberland, and Richard Cail, of Gateshead, for improved deodorizing agents.

1288. William Baker, of Sheffield, for improvements in the manufacture or production of white lead.

1289. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery or apparatus for mixing and moulding materials for the manufacture of fuel, part of which machinery or apparatus is applicable to moulding bricks and other analogous articles,—being a communication.

1290. John Paddon, of Swansea, and William Lowther, of Briton Ferry, near Neath, for improvements in coke ovens,—being a communication.

1291. Frederic Waller Prince, of Wellington-street, London Bridge, for improvements in firearms and ordnance.

The above bear date May 24th.

1292. Ermelinde De Block Stevens, of Antwerp, for improvements in ladies' stays.

1293. Charles Douglas Waddell, of Queen's-terrace, Bayswater, for improvements in ordnance and firearms, and in the application and arrangement of the propelling agents with which they are charged.

1294. John Ingham and George Collier, both of Halifax, Yorkshire, for improvements in the manufacture of fabric of the character of that technically called "camlet."

1295. John Macintosh, of North Bank, Regent's Park, for improvements in breech-loading firearms, ordnance, cartridges, and projectiles.

1297. Benjamin Finch, of Chepstow, for an improvement in the arrangement of the rudders of ships and vessels.

1298. Thomas Dickins, of Middleton, Lancashire, and Gilbert McCulloch, of Manchester, for improvements in machinery or apparatus for spinning and doubling silk, cotton, and other fibrous materials.

1299. George Wallis, of Victoria-grove, Fulham-road, for new or improved methods of preparing drawings, writings, designs, prints, or impressions of engravings and photographs, for the purpose of impressing or engraving the same in or upon metallic surfaces, and thereby producing printing or embossing surfaces or ornamental metallic surfaces for such purposes as the same are or may be applicable to; also new or improved machinery to be employed in the said impressing or engraving.

The above bear date May 25th.

1300. Georges de Laire and Charles Girard, both of Paris, for a new process for manufacturing red and violet colouring matter.

1301. Edward Thomas Hughes, of Chancery-lane, for improved methods of obtaining artificial light, and in the apparatus and burners connected therewith,—being a communication.

1302. John Moule, of Seabright-place, Hackney-road, for an improved apparatus applicable to flushing purposes.

1303. George Elliot, of Houghton-le-Spring, Durham, for improvements in weighing coal at the screen, and in the apparatus for the same.

1304. Gilbert Daniel Jones, of Pentonville, for improvements in the manu-

facture of sand, emery, and glass papers and cloths, and in the machinery employed therein.

1305. Richard Archibald Brooman, of Fleet-street, for treating certain animal substances in order to obtain albuminous, gummy, glutinous, and glairy products and fat,—being a communication.

1306. George Dowler and George James Farmer, both of Birmingham, for improvements in machinery for the manufacture of boot heels and tips, coins, medals, tokens, checks, and such like articles.

1307. John Dale and Heinrich Caro, both of Manchester, for improvements in obtaining colouring matters for dyeing and printing.

The above bear date May 26th.

1308. Samuel Chatwood, of Liverpool, for improvements in iron safes and in locks for the same, which locks are also applicable to other purposes.

1309. George Robinson, of Newcastle-upon-Tyne, for improvements in the manufacture of salts and preparations of ammonia.

1310. Joseph James Welch, of Cheapside, for improvements in collars for gentlemen's, ladies', or children's wear.

1311. William Jeremiah Murphy, of Cork, for an improved motive-power engine.

1312. Thomas Coltman, of Leicester, for improvements in the manufacture of reels for reeling cotton and other thread.

1313. John Henry Johnson, of Lincoln's-inn-fields, for improvements in ruffles or gathered fabrics, and in the apparatus employed in their manufacture,—being a communication.

1314. William Tasker, the younger, of Waterloo Iron Works, near Andover, for improvements in straw-skakers for threshing machines.

1315. Henry Ditchfield, of Calceth, near Manchester, for improvements in machinery or apparatus for folding woven fabrics.

The above bear date May 28th.

1317. Christian Schiele, of Bebbington, Cheshire, for improvements in the manufacture of lubricants,—being a communication.

1319. Charles Berck, of Herve, Belgium, for improvements in the manufacture of the selvages of woollen cloths and other stuffs.

1320. Thomas Gullick, of Pall Mall, for an improved spur box.

1321. John Dugdale, jun., and Edward Dugdale, both of Blackburn, Lancashire, for improvements in the construction of journals and bearings for shafts, spindles, and other similar articles.

1322. Wright Jones, of Pendleton, near Manchester, for improvements in machinery or apparatus for doubling or cuttling woven fabrics, paper, and other similar materials.

1323. William Samuel Nosworthy, of Coleman-street, for improvements in pianofortes.

1324. Floride Heindryckx, of Brussels, for improvements in the construction of railway chairs.

1325. Alexander Samuelson, of Hull, for improvements in gun-boats.

1326. John Trayes, of Belfast, for improvements in steam-boilers, or steam and heat generators, and in the application of heat.

1327. Hesketh Hughes, of Homerton, for improvements in machinery for goffering, fluting, shaping, embossing, and connecting together, lace, ribbons, and other like materials, parts of which improvements are also applicable to the shaping and corrugating of metals.

1328. Alexander John Paterson, of Edinburgh, for improvements in agricultural traction engines and implements.

1329. Robert Hanham Collyer, of Alpha-road, Regent's Park, for improvements in telegraphic cables; also applicable to other similar purposes.

The above bear date May 29th.

1331. Edmond Armand Louis D'Argy, of Paris, for an improved candlestick.

1332. Francis Blakemore Cox, of Birmingham, for improvements in measuring rules.

1333. William Pickstone, of Radcliffe, and William Bacon, of Southport, both in Lancashire, for improvements in machinery for dyeing, washing, and sizing.

1334. Charles Greenway, of Chelten-

ham, for improvements in the manufacture of salt, and in apparatus used therein.

1335. Eugéne Carless, of Bow Common, for improvements in the manufacture of all kinds of candles, for the purpose of rendering them free from guttering.

1336. William Edward Newton, of the Office of Patents, 66 Chancery-lane, for certain improvements in machinery for preparing and spinning hemp and similar fibrous materials, —being a communication.

The above bear date May 30th.

1337. William Renwick Bowditch, of Wakefield, Yorkshire, for improvements in the purification of coal gas, and of coal oils.

1338. Lavington Evans Fletcher, of Upper Norwood, for improvements in steam-engines and boilers, and their appurtenances.

1339. Samuel Rowbotham, of Putney for improvements in the composition and manufacture of soap.

1340. Alfred Vincent Newton, of the Office of Patents, 66 Chancery-lane, for improvements in the application of steam to the warming of buildings and apartments, and in apparatus therefor,—being a communication.

1341. Charles Aldin, of Clapham Park, for an improvement in the construction of paving-tiles.

1342. William Farrell, of St. Helen's, Lancashire, for improvements in apparatus used in hoisting and lowering, as applied to mine shafts.

1343. James Alexander Manning, of the Inner Temple, for improvements in the treatment, application, and use of sewerage matters and the general wastes of towns and factories.

1344. John Kinniburgh, of Shotts Iron Works, Lanarkshire, N. B., for improvements in the manufacture or production of metal pipes and other generally similar tubular articles.

1345. George Mackenzie, of Paisley, and John Hamilton, of Glasgow, for improvements in bobbins or holders for textile materials.

The above bear date May 31st.

NEW PATENTS SEALED.

1859.

2018. George Parsons.
2647. W. H. Ward.
2648. W. H. Ward.
2649. E. T. Hughes.
2651. E. T. Hughes.
2653. Benjamin Bagster.
2659. W. C. Maniece.
2664. W. S. Losh.
2670. J. A. Read and W. Rennie.
2676. L. J. Vandecasteele.
2678. Walker Moseley.
2680. T. Watson and G. Healey.
2682. W. MacNaught and J. L. Taylor.
2683. James Eastwood.
2684. James Eastwood.
2685. Enoch Tomey.
2691. Joseph Bower.
2693. R. A. Brooman.
2694. R. A. Brooman.
2695. F. H. Wenham.
2700. L. N. Dejean.
2707. S. Mortimer and G. Swaine.
2708. Edward Dorsett.
2709. J. M. Wilson.
2710. H. De Matthys.
2711. J. B. Teil.
2715. Achille Mercier.
2728. John Moore.
2741. R. Bond and W. Hayhurst.
2744. John Rudkin.
2745. E. A. Curley.
2747. Edward Kelly.
2748. J. and C. Hawkins.
2751. C. Short, T. B. Smeeton, and W. Bowler.
2754. William Hutton.
2757. François Coignet.
2764. Ferdinand Potts.
2765. Frederick Levick.
2767. James Anderson.
2771. R. H. Collyer.
2773. T. R. Harding.
2776. Joseph Mabbott.
2780. John Arrowsmith.
2781. John Arrowsmith.
2782. J. R. Foord.
2784. Thomas Crook.
2785. W. Prosser and J. Hogg.
2787. F. H. Elliott and C. A. Elliott.
2789. John Macintosh.
2791. John Macintosh.
2792. William Boaler.
2793. J. Lawson and W. Hago.
2794. Joel Spiller.

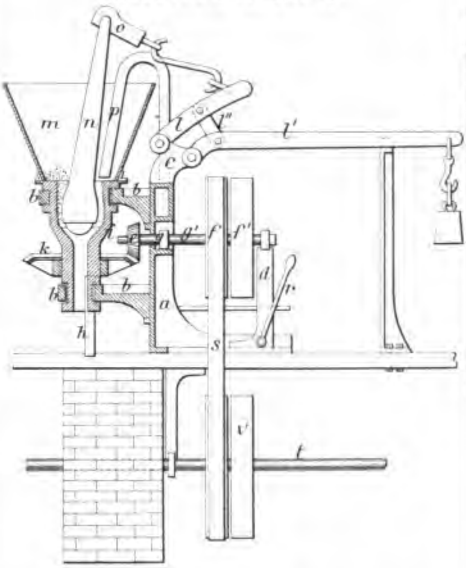
2795. John Tenwick.
2797. J. D. Dunnicliff.
2799. J. R. and H. Thomson.
2802. George Davies.
2807. John Chatterton.
2808. J. L. Bell.
2809. J. Chatterton and W. Smith.
2813. Richard Emery.
2815. P. G. Gennerich.
2817. Patrick Stirling.
2818. G. C. Watson.
2824. William Teall.
2828. J. R. Johnson and J. S. Atkinson.
2830. John Barling.
2831. William Robinson.
2833. J. H. Dickson.
2835. William Clark.
2836. T. Bolton and J. M'Connell.
2837. James Champion.
2838. George Bedson.
2839. George Leach.
2840. S. Bentley and J. Stringer.
2843. Joseph Rhodes.
2844. A. B. Ibbotson.
2845. Wm. Watson.
2848. George Leslie.
2852. Charles Reeves.
2854. Edouard Cormier.
2856. Henry Martin.
2857. Charles Hancock.
2858. William Gadd.
2860. W. H. Harfield.
2862. E. P. Holden.
2863. William Mosley, jun.
2866. Henry Stokes.
2867. Robert Morrison.
2874. T. W. Plum.
2878. G. T. Hinsch.
2879. William Clark.
2882. E. B. Wilson and R. S. North.
2883. G. S. Goodall.
2884. Louis Serbat.
2885. A. Bathgate and J. H. Wilson.
2890. David Hitchin.
2892. James Fairclough.
2895. Michael Turnor.
2898. G. and J. Collier.
2900. William Henderson.
2903. Alfred Welch.
2909. Samuel Plimsoll.
2917. W. E. Newton.
2918. A. V. Newton.
2920. G. F. Stidolph.
2922. M. A. F. Mennons.
2940. H. B. Barlow.
2950. T. S. Truss.
2957. A. V. Newton.
2959. C. J. Rooney and D. Renshaw.
2963. W. A. Gilbée.
2966. G. T. Peppi.
2968. Edward Kirby.
2969. J. S. Crosland.
2970. A. V. Newton.
2971. H. B. Barlow.
2987. William Robertson.
2992. Henry Cochrane.
2994. James Braggins.

1860.

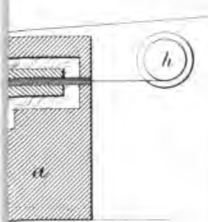
3. William Simons.
9. J. H. Johnson.
37. O. J. T. Gössell.
46. E. J. Harland.
52. John Garnett.
78. A. V. Newton.
103. Thomas Wilson.
119. D. F. L. R. J. Vonwiller and F. Seiler.
148. T. K. Callard.
196. Septimus Beardmore.
222. J. H. Johnson.
223. J. H. Johnson.
276. A. Denny and E. M. Denny.
284. T. Blackburn and M. Knowles.
306. A. V. Newton.
333. William Wain.
335. J. H. Johnson.
385. William Readman.
386. John Green.
406. M. J. Haines.
431. J. H. Johnson.
590. William Bauer.
624. Arthur Paget.
629. Thomas Veal.
631. G. H. Birkbeck.
685. Thomas Wilson.
702. William Wood.
704. James Nixon.
712. T. Richardson and M. Prentice.
731. Jane A. Herbert.
733. Thomas Richardson.
738. John Blackwood.
748. G. T. Peppé.
749. Henry Vigurs.
763. G. K. Snow.
792. H. M. Clarke.
795. W. E. Newton.
799. J. A. De Maniquet.
818. James Buchanan.
825. A. and J. G. Crosskill.
839. Franz Jabure.
845. T. Gamble and E. Ellis.
859. A. N. Jensen.
863. E. H. Ashcroft.
890. J. H. Johnson.
1001. William Macnab.

*** *For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

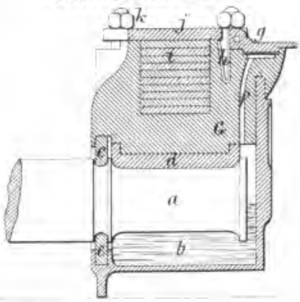
Brooman's oil mill.



steel.



Juzet's axle box.



boot tree

Fig: 1.

Johnson's grinding.

Fig: 1.

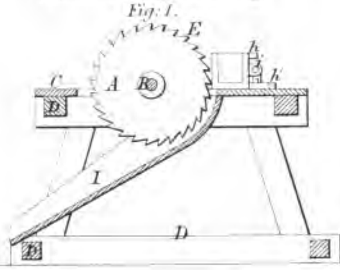
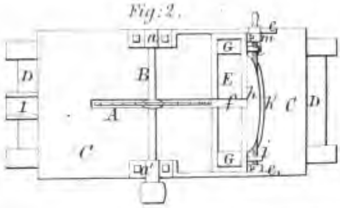
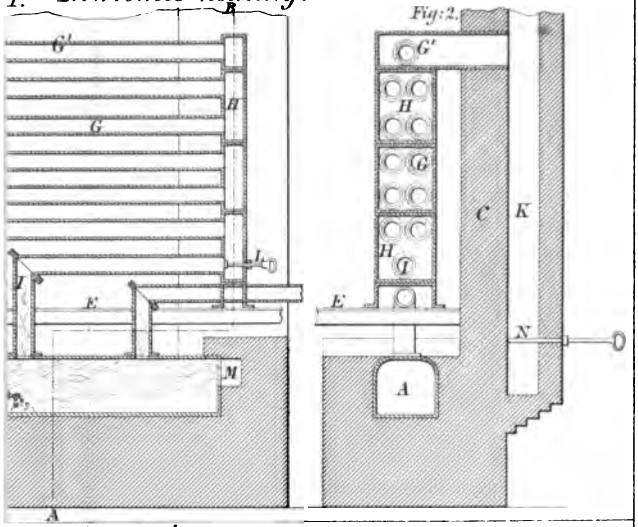


Fig: 2.

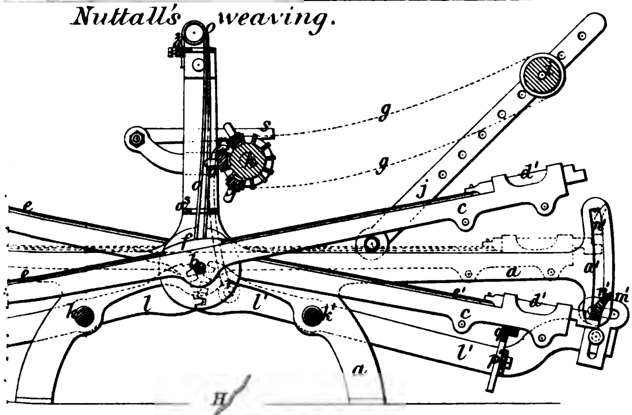


C. Pilling, lith.

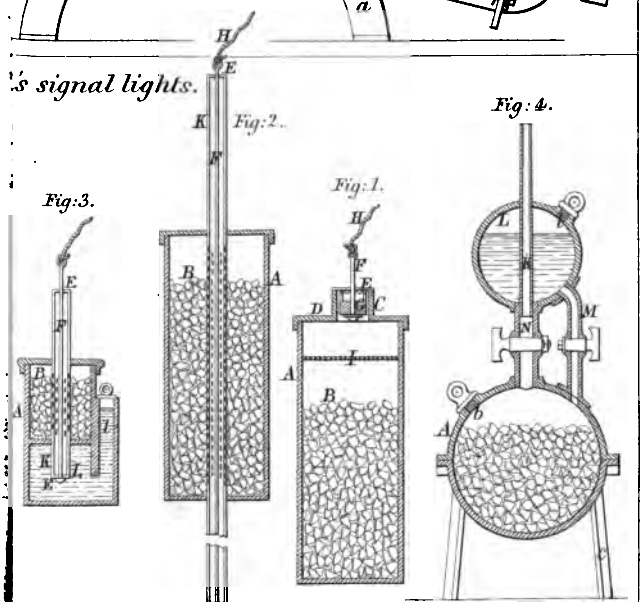
1. Newcome's heating.



Nuttall's weaving.



...'s signal lights.



C. Pilling, lith.

NEWTON'S
London Journal of Arts and Sciences.

No. LXVIII. (NEW SERIES), August 1st, 1860.

THE ROYAL AGRICULTURAL SOCIETY AND THE IMPLEMENT MAKERS.

The defection from the list of exhibitors at the recent Canterbury meeting of the Royal Agricultural Society of most of the leading agricultural implement makers, having called forth severe animadversions from the leading daily and weekly papers, we think it but fair to those who have declined to take part in the public competitions which the Society has for the last twenty years so earnestly and successfully fostered, to make known the reasons which have induced this defection—not that we desire to become the champions of the firms who have struck so serious a blow at the Society from which they have unquestionably derived great pecuniary advantages, and to the interest of whose annual meetings they were therefore under a tacit obligation to contribute,—*but that* the public may understand that it is no slight matter which has drawn forth this strong protest, which, if firmly adhered to on the one hand, and resisted on the other, must eventually reduce the annual gatherings to mere exhibitions of live stock. It is no secret to those who have mixed much with inventors and makers of agricultural implements, that for years past they have expressed discontent at the frequently recurring contests, where they are expected, like prize-fighters, to be always ready to jeopardize their hard-earned reputation, by entering into competition with all comers. The mental labour and anxiety attendant on the effort which firms of repute felt it necessary to make, to retain their position, not merely as manufacturers of the best implements in their several specialties, but also of those that could win prizes, superadded to the ordinary cares of a large manufactory, were found to be so wearing, to say nothing of the inconvenience which personal attendance at the shows, and consequently absence from their works, occasioned, that a deputation of manufacturers brought the matter for consideration before the Council of the Royal Agricultural Society of England, so long ago as November, 1855, when a plan of triennial, instead of annual, trials for certain classes of implements was adopted by the Society, the prize sheet being divided into three sections, viz.: —1. Implements for tillage and drainage. 2. Machines for the cultivation and harvesting of crops. 3. Machines for preparing crops for market and food for cattle. In addition to this movement, a memorial, signed by all the regular implement exhibitors at the annual shows,

with the exception of two dissentients, represented to the Council the general feeling of the manufacturers to be opposed to the existing system of money prizes for competition. "We object," says the memorial, "to this system, on the ground that it operates as an undue stimulus to competition,—tending less to the production of useful and practical machines, than to the development of ingenious peculiarities, by which, with the aid of highly skilled manipulation, the prizes may be won; but more especially is our objection taken on the ground of the unfairness of its operation." For special objects it was proposed to reserve the money prizes, in order to encourage experiments tending to the attainment of practical results altogether beyond the powers of existing mechanism. This, be it remembered, was in the year 1855. In a pamphlet issued by the Association of Agricultural Engineers, in 1857, entitled "The Manufacture of Agricultural Machinery considered as a branch of national industry," the author, who signs himself "A Manufacturer," and who may be assumed to give the views of the Association, in condemning the practice of competitive trials at the gatherings of local societies, says—"Any advantage to be derived by local or district societies from a persistence in prize-giving, is very questionable. The slight benefit it may confer upon the small tradesmen of the neighbourhood is surely purchased at too dear a rate, *by the tendency which it has to repel from the gatherings of such societies those makers of established reputation, by the exhibition and working of whose implements the local maker and farmer could not fail to be benefitted.* Here is a significant hint, and made in the year 1857, of the feeling engendered in the minds of manufacturers by competitive trials. It is not surprising, therefore, that the year 1860 should have witnessed that demonstration of feeling which has excited so much indignation. It would appear that the trial at Canterbury, under the countenance of the Royal Agricultural Society, of implements other than those which were, in the accepted order of rotation, to have competed for prizes, was deemed an infraction of the rule acted upon for the first time last year, by which the trials for the several classes of implements were made quadrennial; and this, with other grievances in the background, sufficed to precipitate a course to which most of the leading firms are now committed. The following is the list of manufacturers, who have withdrawn their names as exhibitors, viz:—

Barrett, Exall, & Andrews,	W. H. Nicholson,
Clayton & Shuttleworth,	Ransomes & Sims,
Crosskill & Co.,	B. Samuelson,
Garrett & Sons,	Smyth & Sons,
Hornsby & Sons,	Tuxford & Sons,
J. & F. Howard,	Whitehouse & Co.

That manufacturers of such repute as most of these, commanding not only extensive capital, but, in their own persons, inventive talent of a high order, should, from a petty feeling of jealousy of unknown or rising men, subject themselves to the taunts, evil surmises, and active opposition of those who have chosen to take the side of the Council of the Agricultural Society, is simply ridiculous. It is possible they may be in fault, though we by no means wish to insinuate that it is so; but that they had at least honourable reasons for adopting the course which they have taken, ought, in the absence of facts to the contrary, to have been assumed. From what we can gather, the following are the reasons which mainly dictated the proceedings which deprived the Canterbury Show of so much attractive machinery, viz:—

1. That the Society has broken faith with the Exhibitors, in departing from the quadrennial system of trials mutually agreed upon. 2. That the prize sheets are so indefinitely worded, that makers are in the dark as to the kinds of machines the Society desires to encourage. 3. That the trials are unsatisfactory and the awards capricious; inasmuch as the time devoted to the trials is necessarily very limited, and no fixed principles of judging are laid down for the guidance of the judges. 4. That the exhibitors have no power to object to the appointment of the judges, whether on the ground of their incompetency, or their business relations, or to the choice of the consulting engineer, who stands in the position of umpire. 5. That the reports of the trials are meagre, inaccurate, and incomplete, and published so long after the show as to be of little service either to the public or the trade. 6. That the expenses of exhibiting and competing for prizes have increased so greatly, that the business resulting from attendance at the Royal Agricultural Show is not commensurate with the outlay.

These are, one would think, tangible objections, and deserving the respectful consideration of a Society professing to promote the welfare of agriculture; but if a true indication of the feeling of the Royal Agricultural Society is to be gathered from the speeches delivered at the annual dinner, war is to be proclaimed against the delinquents who have dared to assert a right which no one would dream of denying to manufacturers in any other branch of industry. When the experience of successive years shows prizes apportioned, not according to real, but presumed merit, and a style of manufacture adopted solely for the purpose of excelling at competitive trials, it is time for honest men to speak out. In the pamphlet before referred to, the writer, quoting from the Society's own Reports, shows that, in respect of agricultural engines, this system was so generally recognised, that one well-known class was denominated "racers," from being designed solely with the view of performing great feats, not however without the nicest skill being required to bring out the result. There has, in fact, been imported into agricultural machinery (by

reason of the tests of merit being determined solely by the amount of steam generated from a given quantity of fuel, or of power consumed, as indicated by the dynamometer), a system almost identical with that of light weights, which has found so much favour with the Jockey Club; and if among the council of the Royal Agricultural Society there was no Lord Redesdale to expose the folly of the system, it was time for the leading agricultural implement makers, who saw but too clearly the danger to which it tended, to make a stand for the cause, which its acknowledged advocates had, to some extent, forsaken; for no one can seriously suppose that to produce machines utterly unfit for the rough work of the farm, is to promote the welfare of British agriculture, however satisfactory may be the results of those machines, in the hands of trained men, in the show yard of the Society. What the implement makers ask for, and it is no outrageous demand, is "that trials of agricultural machinery should be of longer continuance than heretofore, and conducted as much as possible in the manner, and under the same circumstances, that such machinery will be used, in the ordinary practice of farming." If this be granted, racing engines and machines will quickly disappear, for they would break down or blow-up under actual work, but if refused, manufacturers of established reputation are justified in discountenancing the distribution of prizes under such circumstances. Again, they have a right to know, now that implements have arrived at a certain stage towards perfection, what are the precise points of improvement which the Society desires to see embodied in future implements. But at a recent conference, the Implement Committee refused to explain to a deputation of manufacturers, who waited on them, the views of the Society as expressed in their prize sheets. Considering the amount of good which the Royal Agricultural Society has already conferred on the country, and admitting, as we do, its ability still further to benefit agriculture, we are sorry to see this antagonism among its members; for, if not removed speedily, it must have a serious effect on the influence for good of the Society. At the same time, we think the connection of the Society with agricultural implement trials had better cease altogether, than that the makers should be dragooned into a service which must draw off their attention from following out substantial improvements, and entail on them such expenses as must necessarily enhance, instead of cheapening, their implements. We trust, however, for the sake of all, that the breach may be healed by a timely concession on the part of the Society; and that no such attempt, as has been threatened, will be made by the squirearchy, through exclusive dealing, to put down the little band of protestors; for they may find that they are tilting at a power, which, whether viewed politically, or commercially, is not to be despised.

PROGRESS OF PATENT LAW ADJUDICATION REFORM.

WHEN it is remembered how many years were required to make sufficient impression on the Legislature to secure the enactment of the patent law of 1852, it will not be surprising that no legislative step has yet been taken towards remodelling the course of procedure in cases of alleged infringement of patents, notwithstanding the accumulating evidence of the necessity for reform in this particular. We have noted from time to time the opinions of judges on this point, who, from their position, are induced to speak in general, rather than specific, terms, when treating of the subject; from them, therefore, we cannot hope to gain more than the expression of a wish for reform; but from others not hampered by the etiquette of office, although as competent, perhaps, to form an opinion, we are occasionally enabled to obtain a more definite public expression of their objections to the present system. Of these, Mr. Grove, Q.C., whose high attainments, both in science and law, gives peculiar weight to whatever he may have to say respecting patents, has recently given the public the benefit of his opinion, at some length in a legal journal.* "Great defects," he says, "exist in the trial of patent cases, some of which are incidental to other forms of litigation, but some are peculiar to patent cases. In the courts of justice of this country, the litigant who has, by his counsel, the first and last word, has an undoubted advantage over his opponents . . . . in patent cases the the advantage is greater than in any other class of cases." In support of this assertion, he says:—"The case is shaped adroitly, and the minds of the jury are generally moulded in the groove laid down by the advocate for the plaintiff, without being at all conscious of it. The cases generally last so long, that in spite of every desire to do justice, weariness prevents proper attention to the defendant's case; all that is interesting in the scientific questions having been already exhausted." As a remedy for this evil, he urges what has again and again been suggested without effect, viz., the establishment of a special court, having exclusive jurisdiction over patents, not merely for trying facts in dispute, but for settling such points as now come before the judges *in banco*, the former with the aid of a jury, the latter by the court alone. The history of patent causes tried within the last twelve months

* See the *Jurist*, for January 28th, 1860, where, in a paper entitled "Suggestions, for Improvements in the Administration of the Patent Law," Mr. Grove advocates the establishment of a special court, not only for the trial of patent cases, but for the granting of patents,—basing his argument on grounds which are tenable only when furnished by the author's experience, but which, when taken on trust, are as hollow as a counsel's encouraging smile, while luring a hostile witness into a pit-fall.

would, if it were but written, form a most instructive comment on this proposition; for, setting aside all reference to the cost of trials, as now conducted, and the, in general, unsatisfactory nature of the decisions, when finally secured, the money value of the question at issue nine times out of ten would poorly compensate for the anxiety consequent on the slowness of the proceedings, and the time and attention demanded of the litigants, in following the cases from court to court, when the first verdict of the jury is not accepted as a final settlement. To refer to the case of Seed *v.* Higgin, in which Mr. Grove was recently engaged, in the House of Lords, in unravelling its complexities for their lordships' final decision.—This, when first brought into the Queen's Bench Court, in July, 1857,* was a simple case of alleged infringment; the plaintiff, Seed, having patented a "presser" to be applied to the leg of a "flyer," used in spinning machinery; which presser was put into action by centrifugal force, in lieu of a spring, which is the means usually employed; and the defendant having used a presser acting on a similar principle. Besides the question of similarity between the two plans, which was for the jury, and was decided in favor of the plaintiff, the construction of the specification, involving both the question of infringement and validity of the patent, came under discussion, and was reserved. A rule having been obtained by the defendant for leave, on due cause being shown, to set aside the verdict, and enter it for the defendant, the points reserved came on for discussion, and eventually the rule was discharged, and the verdict confirmed. So far the case still remained a simple one, differing in no respect from a hundred others; but the defendant, not satisfied with the decision of the Queen's Bench, moved the Court of Exchequer Chamber, and obtained from that court a judgment, to the effect that the patent of the plaintiff, Seed, was good, but that there was no evidence of an infringement by the defendant. Thus, both parties were thrown upon their backs, or rather, both succeeded to a certain extent—the one obtaining a confirmation of the validity of his patent, which had been seriously questioned, and the other the verdict for which he contended. So unsatisfactory, however, was this decision, that, both feeling aggrieved, and being alike advised of the illegality of the judgment, they both applied to the highest court of judicature; and, on the 4th and 5th of June last, nearly three years after the first trial, the case was argued before the House of Lords. For the present, the judgment of their lordships is deferred; and, indeed, so knotty are the points raised, that there is no wonder they should take time to consider. But if a court were specially constituted to try patent causes, it would be simply impossible to contrive such a labyrinth of perplexities as this case has had to wade

* For report of this trial see Vol. VI., p. 174, New Series.

through to its final settlement. Another case, of still more recent date, viz., Ralston *v*. Smith, tried in the Court of Common Pleas, before Chief Justice Earle, June 15th, 1860, for the alleged infringement of a patent, for "improvements in embossing and finishing woven fabrics," affords, also, a striking example of the inefficiency of the existing tribunals for settling disputes arising out of patents; for although a jury was empanelled, and a liberal supply of witnesses provided for their entertainment, there proved to be no fact in dispute; they were consequently discharged; and, as respected the points of law raised by Mr. Grove, the defendant's counsel, the presiding judge could do no more than reserve them for the consideration of the full court.

While, however, the Anglo-Saxon race is content to wait patiently for the benefits which ripe legislation can alone effectually confer, they are addicted, when matters come to the worst, to seek a short and decisive method of meeting a difficulty. In the present number of this Journal we give an illustration of this, under the head of "Scientific Adjudication." In the case referred to, Wheeler *v*. Turner, the litigants were content to leave the matter in the hands of their respective patent agents, binding themselves by articles of agreement to abide by their decision, assisted by an umpire. The arbitrator appointed by the plaintiff was Mr. William Carpmael, and by the defendant, Mr. W. E. Newton, who called to their aid Mr. Spence, a gentleman favourably known to the legal profession, and also to patentees, as the author of a "Treatise on the Principles relating to the Specification of a Patent for Invention," and of other works touching on patent law. Without claiming for this arbitration any special merit, on the ground of a thorough and searching investigation of the facts in dispute, or of a more satisfactory decision than could otherwise have been arrived at, we think it may fairly challenge comparison for soundness with any judgment which we have recorded in this journal for a long period. With these observations, we commend the case to the attention of our readers, and trust that, if they should unfortunately see before them the prospect of litigation, they will, ere committing themselves to a course that may carry them eventually to the House of Lords, consider whether, by means so simple, and comparatively inexpensive, as the proceedings to which Messrs. Wheeler and Turner resorted, they cannot secure an intelligent and impartial decision of the question at issue.

RECENT PATENTS.

To Frederick Augustus Abel, *of Woolwich Royal Arsenal, for improvements in protecting from fire textile materials in the raw or in the manufactured state.*—[Dated 23rd December, 1859.]

The improvements forming the subject of this invention consist in affording protection against fire to textile materials in the raw or in the manufactured state, by impregnating such materials with insoluble metallic silicates within the fibre of the material.

The process by which this is effected is as follows:—Prepare a solution of lead, of zinc, or, practically speaking, of any other metallic base capable of forming, by its action upon a soluble silicate, a double silicate, insoluble in water, and, by preference, a basic acetate of lead, prepared, as is well known, by boiling sugar of lead and litharge with water. It has been found that solutions of various strengths will answer the purpose, yet the one preferred is prepared by boiling together twenty-five pounds of sugar of lead, fifteen pounds of litharge, and forty gallons of water, for about half an hour, and allowing the same to stand for about a couple of hours; the decanted clear solution forms a liquor well adapted to the purpose of the patentee.

To use the liquor so prepared, and which, in the present instance, is a solution of basic acetate of lead, the patentee takes such a quantity of it as will be at least sufficient to cover completely the fabric or material intended to be made uninflammable, or else the fabric or material may, in many cases, be simply passed through the liquid, raised to nearly the boiling point; the object being simply to saturate or impregnate it thoroughly with the liquor. This having been done, the fabric so saturated with the liquor is to be removed, and spread out for about twelve hours to the contact of the air. This hanging out of the fabric or material to the air may be dispensed with, but it is preferred to do so, the subsequent operation now to be described yielding then a better result.

The fabric, after having been subjected to the first operation just described, should now be immersed for a period of from one to two hours, or thereabouts, in a hot and moderately strong solution of an alkaline silicate, by preference, in silicate of soda. It should then be withdrawn from the bath of alkaline silicate, allowed to drain, washed thoroughly in soft water, and dried; when it will be found to have acquired the properties claimed for it.

The patentee does not confine himself to the use of any particular silicate, or of any metallic salt, nor to the precise *modus operandi* described; but he claims, "protecting from fire textile materials in the raw or in the manufactured state, by the production of an insoluble silicate within the fibre or texture of the said textile materials."

To WILHELM ADOLF VON KANIG, *of Hardinge-street, Islington, for improvements in the manufacture of starch and compounds of starch, and in extracting gum, dextrine, and grape sugar therefrom.*—[Dated 31st August, 1859.]

ACCORDING to this invention, the operator is to take sago or other farinaceous or vegetable substance containing starch, such as wheat, rice, barley, oats, millet, rye, maize, buck-wheat, peas, beans, potatoes, tapioca, mandioca, and other materials containing starch, and first steep them in water, as commonly practised, or in a weak solution of chlorine, and when sufficiently softened and crushed to a pulp in the ordinary way, he is to proceed to mix therewith a purified solution of chloride of lime (composed by mixing one pound of chloride of lime with about three gallons of water), and steep the pulp therein for about three hours, more or less, in order to dissolve the gluten from the starch, and also to make it soluble, keeping the whole well stirred during this time; after which the starch may be removed from the pulp in the ordinary way. The impurities and chlorine are then to be removed from the starch by frequent washings in cold water, until the water appears quite clear, by which a pure starch is obtained soluble in boiling water. Or, instead of operating with the chlorine in the manner above stated, the starch may first be extracted from the pulp and afterwards be operated upon with the chlorine, as above stated. In operating upon either of the above-mentioned farinaceous or vegetable substances after they have been reduced to a powder or flour, they are to be cleansed from impurities with cold water in the usual way; the chlorine solution before mentioned is then to be added (keeping it well stirred for about three hours or more, as before stated), and washed frequently in cold water, as before stated: the result is a pure starch soluble in boiling water.

To make compounds of starch, take fifty parts of the ordinary starch, and mix therewith fifty parts of sago, and conduct the remainder of the process in the manner before described, by which means a refined and soluble starch will be produced.

In manufacturing starch intended to be used by calico printers, the patentee mixes with the first above-mentioned starch a solution of tragacanth gum, in the proportion of about three ounces of the solution to every 112 pounds of the starch.

Starch manufactured by the improved processes is capable of yielding gum dextrine and grape sugar, which may be obtained in the ordinary manner.

The patentee claims, "the use of chlorine in and for the manufacture of starch and compounds of starch, as above stated, and for the purpose of converting insoluble starch into soluble starch, and for separating the gluten from the starch; and also the use of chemicals other than chloride of lime possessing chlorine either separately in themselves or by combining two, three, or more chemicals together to produce chlorine therefrom."

To EDWARD SQUIRE TEBBUTT, *of Leicester, for an improved manufacture of elastic fabrics.*—[Dated 25th October, 1859.]

THIS invention consists in cementing or connecting any ordinary and suitable woven fabrics together by means of threads of india-rubber of such fineness as will admit of a considerable number of such threads being placed side by side within the space of an inch; by this means, a cloth with a plain even surface is produced, possessing the required amount of elasticity, and possessing also the desirable quality of being equally pervious to the passage of air, as is the case with the ordinary shurred or corrugated india-rubber goods.

The best result is obtained when the number of india-rubber threads used per inch corresponds to the gauge of the thread itself. Thus, for instance, if No. 40 india-rubber thread be used, about forty threads per inch should be put into the fabric, and so on according to the number or gauge of the india-rubber thread employed in producing the compound fabric. The fine threads of india-rubber should be inserted in a dry and distended state between two pieces of any other suitable fabric or fabrics (woven or otherwise), such fabrics being first coated with india-rubber or other suitable adhesive cement. The cemented surfaces are then brought into close contact with the dry and distended threads of india-rubber, by means of pressing rollers, before the cement becomes set. The materials are then kept in close contact and in a distended state until the adhesive cement has become sufficiently dry to cause the whole to adhere firmly together. The compound fabric is then allowed to contract, and the result will be a compound elastic fabric, the surfaces of which are of an even or cloth-like character, free from corrugations or puckers. In some cases, the patentee coats the threads of india-rubber with adhesive cement immediately before bringing them into contact with the cemented surfaces of the fabrics that form the outer portions of the compound fabric, and it is then not necessary that the cement on the inner surfaces of the fabrics should be in an undried state at the moment of contact with the cemented threads of india-rubber; but this is not an absolute condition, as the whole of the materials forming the compound fabric may be brought into contact while the cement on the whole or any portion thereof is in an undried state. After the compound fabric has become firmly united by pressure, and the complete drying of the cement with which the whole is caused to adhere, the compound fabric may be allowed to contract, and such contraction may be assisted by moisture or heat, or by both, at the will or pleasure of the operator.

The patentee claims, "the manufacture of a compound elastic fabric, the surfaces of which are made of an even or cloth-like character, and free from corrugations or puckers, by the cementation of a sufficient number of threads of india-rubber between two pieces of any suitable fabric or fabrics, as herein described."

To HENRY NAYLOR and WILLIAM CROSSLEY, *both of Calder Vale, near Todmorden, Lancashire, for improvements in pickers used in looms for weaving.*—[Dated 19th November, 1859.]

THIS invention relates to an improvement on that class of pickers the upper ends of which work on a spindle or rod, and the lower end in a

slot in the bottom of the shuttle-box, both the spindle and slot forming guides for the picker.

In Plate III., fig. 1, is a side view, and fig. 2, is an edge view, of a picker constructed according to one modification of the invention. The strips of hide forming the picker are folded so that their edges will strike against the point of the shuttle when the picker is working,—the folds being arranged so that the point of the shuttle will come as near as possible against the point marked *a*. The hole for the spindle is marked *b*; the part which slides in the slot at the bottom of the shuttle-box *c*; the slot by which the picking band is attached to the picker *d*; and the wire staples passing from one side through the picker *e*, the same being clenched on the other side to secure the strips. This picker may be used without, but works with less friction on the spindle when metallic rings *f*, are inserted, as shown in dotted line. These rings are inserted at the time the strips are folded, so as to be firmly secured.

Fig. 3, is a side view, and fig. 4, an edge view, of another picker made according to these improvements. It is similar in construction to that shown at figs. 1 and 2, except that the provision made for the attachment of the "picking" band is different, one strip of hide being secured so as to leave a space *d*, between it and the upper part of the picker. In this modification, a method of applying a metallic bush is shown, which is to extend from one side of the picker to the other; this bush *f*, being a tube with a flange at each end, which is encircled by the strips of hide when the picker is constructed.

Fig. 5, is a side view, and fig. 6, an end view, of a picker constructed in two distinct and separate parts. The lower part is similar to the pickers shown by figs. 1, 2, 3, and 4, but the upper part, is formed of strips of hide having their edges in the same direction as in the common picker, the upper and lower parts being secured together by a screw-bolt. *b*, are the holes for the spindle; *d*, the slot for attaching the picking band. *f*, *f*, are two metallic bushes, each forming part of a plate f^1, having a hole through it, so as to be secured by the bolt *g*. With pickers constructed in the manner shown by this modification, when one part is worn out, a new part may be substituted, instead of having to replace the entire picker, as hitherto.

Fig. 7, is a front view of another picker, similar to that shown by figs. 5 and 6, except that the sides are of increased strength, and the holes, *d*, for the spindle are bushed in a different manner. In this case, the bushes *f*, are formed by a tube having a flange at one end, and when passed through the hole, as shown, a washer f^1, is placed on the end of the tube, and it is expanded or rivetted over, so as to be held secure.

Fig. 8, is a side, and fig. 9, an edge view of a picker, in the upper part of which metal is substituted for strips of hide. The metal may be brass, wrought iron, or malleable cast iron. The picking band is attached to the part *d*. Fig. 10, is a side view, partly in section, of the upper part of the picker shown by fig. 8, but modified, so that the holes for the spindle *b*, may be bushed with bushes *f*, as shown, which may be renewed when worn.

Fig. 11, is a side view of a picker, somewhat similar to that shown at figs. 3 and 4, as a metallic bush is used, but the two ends of the bush are connected by a part *d*, to which the picking band is attached, and a part f^1, descends from the lower side of the bush, to prevent it from turning.

The patentees claim, "Firstly,—pickers, both with and without bushes, constructed as described, and shown in figs. 1, 2, 3, and 4; also pickers constructed substantially as described, and shown in fig. 11. Secondly,—the construction of pickers in two separable parts substantially as described, and shown in figs. 5, 6, 7, 8, and 9. Also, forming the upper part of the picker of metal, and the lower part of buffalo hide, substantially as described, and shown by figs. 8, 9, 10, and 11; and the manner of bushing, as described, and shown in figs. 7 and 10."

To Samuel Evans, Walter Evans, and Henry Evans, *all of Derby, for improvements in polishing thread and yarn, and in machinery to be employed for that purpose.*—[Dated 10th November, 1859.]

According to this invention, the threads or yarns to be polished are, when sized and in a damp state, passed over the surface of a polished rapidly revolving heated cylinder, to the periphery of which is attached at intervals narrow brushes or strips of cloth, for causing the fibres of the thread to adhere and lie in one direction, whilst the thread is dried and polished by the combined action of the bright heated cylinder and the brushes or other material attached to them. Thread or yarn may be polished in the above manner when in the hank or skein, or whilst passing from one beam to another, as in the common sizing or dressing machine, or during their progress from one set of bobbins to another.

In Plate III., fig. 1, is a side view, and fig. 2, an end view, of a machine arranged as above described, for polishing threads in the hank or skein. *a*, is the framing of the machine, on which is mounted the hollow bright-metal cylinder *b*. The axes of the cylinder are hollow, and one axis is connected by means of the stuffing-box *c*, with the steam pipe *d*; the other axis is connected in a similar manner to the pipe *e*, through which the condensed water is carried away,—the pipe *e*, being bent downwards within the cylinder, so that its end is close to the lowest part of the cylinder. The cylinder has three grooves formed in it, into which the brushes or strips of felt *f*, are fixed. The brushes may be fixed in the grooves by small screws; or, when strips of felt or other yielding material are used, they may be fixed in the grooves as shown at fig. 4. The cylinder is set in motion by a pulley *g*, on one of its axes, which is caused to rotate by the strap g^1. The hanks to be polished are spread over and stretched between two rollers *h*, *i*, the axes of which are parallel with the axis of the cylinder; the upper roller *h*, turns in bearings in the top of the framing vertically above the centre of the heated cylinder. The lower roller *i*, is supported on the weighted lever *k*, which turns on a centre at *l*, and is sufficiently below the centre of the cylinder *b*, to cause the hanks to press against the surface of the cylinder. On one end of the roller *h*, there is a toothed wheel, to which motion is communicated by a toothed wheel on a short axis, on which is a pulley *m*, to which a slow motion is given by a strap. When the rollers *h*, and *i*, with the hanks spread upon them, are in position, the cylinder *b*, is caused to revolve rapidly, and the hanks are moved slowly round by the roller *h*. When the hanks are dried and polished, the roller is lifted out of its bearings, and moved down the incline on the top of the framing to the point *n*, and the lever *k*, is

lifted so as to take the tension of the hanks. The hanks are then removed, and another set of hanks arranged along the rollers. On each side of the machine there is a like arrangement of rollers for supporting the hanks to be polished, so that, when the upper roller, on which one set of hanks is spread, is moved out of its bearings and down the incline to one side of the machine, another roller, having another set of hanks spread on it, is moved up a similar incline from the other side of the machine into the bearings above the heated cylinder; so that one set of hanks may be arranged on one set of rollers, whilst another set of hanks, on the other set of rollers, is being polished.

Fig. 3, is an end elevation of a machine arranged for polishing thread whilst passing from one set of bobbins to another, or from one beam to another. The threads are wound on a set of bobbins previous to polishing, and pass through a trough *b*, containing size, the superfluous size being pressed out by the rollers *c*, and *d*; the required tension being put on the thread by retarding the roller *c*, by means of a strap and weight *e*. *f*, represents the framework of the polishing machine; *g*, the rapidly revolving cylinder, supported, as in the machine above described, on hollow axes, and heated by steam supplied by the pipe *h*, through one of the hollow axes. *i*, and *k*, are rollers over which the threads are wound in a spiral form during their progress, and are so placed that the threads, whilst stretched over them, are slightly pressed against the heated cylinder. To the end of the upper roller a stepped pulley *m*, is attached, which is driven by a similar pulley *n*, on the axis of the cylinder *g*, and by which the speed of the rollers is regulated; or the roller *i*, may be driven by suitable wheel gearing. *l*, is a reed, which guides and separates the threads. In working the machine, the threads, after passing the sizing trough in the form of a small warp, are passed under the roller *k*, and are threaded through a portion of the reed, either singly or a few threads together; they are then passed over the upper roller *i*, and again threaded through the next portion of the reed; they are then again passed under the roller *k*, through the next portion of the reed and over the roller *i*, and so on until the reed is filled and the rollers covered; the threads being wrapped helically over both rollers from end to end, and separated and kept in their places by being passed through the reed at each wrap. The cylinder is then set in motion by a driving-pulley, and revolves rapidly, whilst the upper roller *i*, is driven slowly by the pair of stepped pulleys *n*, and *m*. The roller *i*, in its revolution, carries the thread forward,—drawing it slowly from the bobbins through the sizing trough and on to the rollers, and again giving it off at the delivery end. The threads in their progress, and whilst distended between the two rollers, are polished and dried, and caused to acquire a glacé appearance by the friction of brushes or other materials attached to the cylinder, and by the heat of the cylinder itself. The finished threads, on leaving the roller *i*, may be either wound at once on to separate bobbins on a common winding machine, or they may be wound on to a small roller, and from thence transferred to the winding machine.

The patentees claim, "the polishing threads or yarns by the friction of a rapidly revolving heated metallic cylinder, having strips of a yielding substance attached at intervals to its periphery, as herein described."

To John Knight, *of Newton Heath, near Manchester, for certain improvements in or applicable to looms for weaving, part of which is applicable to lubricating axles and bearings for other purposes.*—[Dated 19th November, 1859.]

The first part of this invention consists in japanning the boxes and covers of roller temples, to prevent them from rusting when the fabric is woven in a wet or damp state, and to economize the labor of polishing.

The second part of the invention consists in forming a spiral groove or spiral grooves in contrary directions on the crank axle or other axles of looms; these grooves extend the length of the bearings, to retain and distribute the lubricating material.

The bearings are or may be made with shoulders, to prevent the escape of the lubricating material laterally; or the spiral grooves may be made in the bearings, and the axles can remain plain. This second part of the invention is also applicable to axles and bearings for other purposes.

In Plate III., fig. 1, is part of the crank-axle of a loom to which the improvements are applied. *a*, is the journal, in which are turned or otherwise formed two spiral grooves in contrary directions, extending the whole or nearly the whole length of the bearing, so that the oil supplied at *b*, may be distributed all over the bearing. A circular groove may be made at each end of the bearing, to prevent the escape of the oil. *c*, is the crank, also made with two spiral and two circular grooves, which serve as reservoirs for the accumulation of the oil, which is given out as required.

The patentee claims, "First,—the japanning the boxes and covers of roller temples, to economise labor and prevent rust, as described. Secondly,—the forming grooves in axles and bearings, for containing and distributing lubricating material, as described. And, Thirdly,—the forming shoulders on bearings to prevent the escape of the lubricating material, as described."

To Benjamin Bagster, *of King's-road, Gray's Inn, for improvements in means or apparatus for giving surface finish to paper; which improvements are applicable to copper-plate and other printing, as also to embossing.*—[Dated 23rd November, 1859.]

This invention relates to apparatus for effecting the pressing processes in giving surface finish to paper, as well as in copper-plate and other printing, and in embossing, in order that pressing surfaces of a cylindrical or segmental character, may have an alternating motion given to them.

In Plate III., fig. 1, shows a longitudinal, and fig. 2, a transverse section of parts of apparatus arranged according to this invention. *a*, *b*, are two portions or segments of cylinders, affixed respectively to axles a^1, and b^1, by which they are supported, so as to turn in bearings, which may be adjustable in a suitable framing. The two segments *a*, and *b*, are connected together, so that whatever movement is given to one segment may be simultaneously given to the other, by means of the links *c*, *c*, which are connected together by pin joints at c^1, whilst their other ends are respectively connected by pins c^2, to the segments *a*, and *b*. *d*, is the main driving axle, upon which is affixed the pulley d^1, which receives motion

by means of a strap from a steam-engine. Upon this axle *d*, is also affixed a pinion d^2, which takes into, and gives motion to, the wheel *e*, upon the axle e^1. This wheel *e*, drives the toothed wheel *f*, upon the shaft or axle f^1, upon which is also affixed the compound pinion *g*, having two sets of teeth 1, and 2. The teeth 1, are adapted to take into the teeth 3, of the segment *a*, whilst the teeth 2, gear into the teeth 4, of that segment, so that the segment may be caused to make partial rotations in one or the other direction, according to which surface 1, or 2, of the wheel *g*, is for the time in operation. The change of relative position of the wheel *g*, is effected by the sliding endways of the axle f^1, which motion is obtained by a lever *h*, which turns upon the axle h^1, whilst it embraces the neck f^2, of the axle f^1, and at the other end is controlled in its movement by passing within the cam groove formed in the surface of the drum e^2. This cam course is so formed, that during its revolutions, it will successively, by means of the lever *h*, acting on the axle f^1, cause the wheel *g*, by acting on the teeth 3, to move the segments for a partial rotation in the direction of the arrow *z*, and then for a time hold the pinion *g*, between the two sets of teeth 3, and 4, and move it into contact with the teeth 4, to cause the segments to make a partial rotation in the opposite direction, when the wheel *g*, will again be shifted for a time into a position intermediate of the teeth 3, and 4, and then back into contact with the teeth 3, and so on successively. The apparatus, as shown, is adapted for pressing single sheets of paper, which are placed between the bed-plate *i*, and the plate *j*. The bed-plate *i*, is supported so as to be capable of travelling on bearings affixed to or formed in the main framing, as moved to and fro by the action of the segments *a*, *b*; and the plate *j*, is connected to the bed *i*, by links *k*, one at each side; and the plate *j*, is provided with horns j^1, j^2, by which it is alternately raised at one and then the other end, by the action of the segment *b*, thereon, to admit of sheets of paper being introduced between that plate and the bed plate *i*. The paper may be introduced in single or other number of sheets, folded or otherwise, and may be introduced and withdrawn successively from the opposite sides, as the parts assume the respective positions for such purpose. The surfaces of the bed *i*, and the plate *j*, may be polished, or other plates may be applied thereon having the desired surface polish, or with surfaces embossed to the figures or configurations desired to be imparted. When hot-pressing or embossing is required, the plate *i*, may be formed hollow, for the admission of steam, by suitable flexible or jointed pipes; or heat may be imparted to the bed-plate *i*, by jets of gas, the pipes of which are supplied from suitable flexible or other tubes, adapted to admit of the motion given to the plate *i*.

Apparatus with alternating surfaces of the character explained, is also applicable to copper, steel plate, and other printing and pressing processes, facility being given by its double action, for the employment of both ends for filling and taking out the work.

The patentee claims, "the adaptation, combination, or arrangement of means or apparatus to be used in giving surface finish to paper, and in the processes of copper-plate and other printing and embossing, substantially as explained."

To James Eastwood, *of Litchurch, Derbyshire, for improvements in steam hammers, and in valves to be used therewith.*—[Dated 28th November, 1859.]

This invention consists in constructing the standards of steam tilts or hammers of wrought iron, to form guides for the hammer trip, and in securing the bottoms of the standards into the anvil block, and securing the cylinder between them at the top. The invention further relates to a valve of a cylindrical form, having flanges at each end, so as to leave a chamber for steam between the valve and the outside casing.

In Plate III., fig. 1, represents a sectional elevation of a steam hammer constructed according to this invention; and fig. 2 is a horizontal section on a large scale, taken through the valve and cylinder. A, is the cylinder, made of wrought or cast iron, fitted with the vacuum valve B, which is held in its proper position by the spiral spring C, in the usual manner. The cylinder is firmly bolted to the standards D, forged to the required shape, and having the guide-pieces E, formed on their insides. These standards are turned at their ends F, to fit holes previously bored in the anvil block G, and are secured therein by the cotters H, or the ends may be flattened out to form feet, and be keyed and dovetailed into the anvil block. The anvil itself has a shank I, cast on it, and is fitted into a recess cast in the bed-plate or block, as shown by the dotted lines fig. 1, a hole being cast transversely in the block at J, to admit the end of a bar for forcing the anvil out of its socket when the anvil is to be changed. When the piston K, rod L, and trip M, are formed of one forging, as shown, the bottom cylinder cover N, and glands O, are put together in halves vertically, and the joints secured by bolts. On steam being admitted from the boiler into the pipe P, the hand lever Q, which communicates with the stop-valve R, by means of the rod S, and lever T, is moved so as to admit the steam down the port U, into the steam chamber V, surrounding the valve, thence through the steam ports W, into the cylinder. The piston rod and trip being thus raised, the tripper slides X, are brought into contact with the rollers Y, on the end of the lever Z, which may be adjusted to give a blow of the required force, or by fixing both the tripper slides on one side of the trip, and in that case using one lever only.

In fig. 2, the valve rod *a*, works steam-tight through the gland *b*, actuating the cylindrical valve *c*; V, is the steam chamber round the outside of the valve, the interior *d*, forming the exhaust passage communicating with the exhaust pipe *e*, the two chambers being kept steam-tight and apart by the packing rings *f*.

The cylinder A, may sometimes be secured to the standards D, by longitudinal flanges and bolts, and recessed to lighten it, and, if necessary, to admit of projections left on the standard for taking the strain off the bolts.

The patentee claims, "First,—the general construction and arrangement of steam hammers and valves to be used therewith, as described. Secondly,—the constructing of the standards of steam hammers or tilts of wrought iron. Thirdly,—the system or mode of fixing or securing the standards of steam hammers or tilts to the anvil block, as described. Fourthly,—the system or mode of securing the cylinder of steam hammers or tilts between the standards, as described. Fifthly,—the peculiar construction and arrangement of cylindrical valves for steam hammers or tilts, as described."

To Nathaniel Clayton *and* Joseph Shuttleworth, *both of Lincoln, for improvements in steam-boiler safety-valves.*—[Dated 3rd December, 1859.]

The figure in Plate III., is a longitudinal section of a steam-boiler safety-valve constructed according to this invention. *a*, is a short tube projecting from the top of a boiler: the upper end of this tube is closed by the valve *b*. *c*, is a spiral spring enclosed within the tube *d*: this tube is closed at the bottom, and, on the under side of the closed end, there is a projection d^1, which presses on the valve *b*. The top of the tube *d*, is open, and the exterior of the top of the tube fits accurately and slides within a short tube *e*: this tube is closed at the top, and is carried by standards *f*, from a ring *g*, which screws on to the top of the tube *a*. The top of the spiral spring bears against the closed end of the tube *e*, and the bottom of the spring presses on the closed end of the tube *d*, and forces the projection d^1, on to the valve *b*, and the valve is thus kept against its seat. A portion of the under side of the ring *g*, is cut away, in order that, when the ring *g*, has been screwed on the tube *a*, a piece *h*, fitting the notch in the ring *g*, may be slidden over a projection *i*, from the side of the tube *a*, and its upper end caused to enter into the notch in the ring; the shackle of a padlock *k*, is then passed through a hole in the projection *i*, so that unless the padlock is removed, the piece *h*, cannot be withdrawn from the notch in the ring *g*, and consequently the driver of the engine will not be able to alter the pressure on the valve *b*, by unscrewing the ring *g*, from, or screwing it further on to, the projecting tube *a*.

To Charles Sells, *of Stockwell, for improvements in steam-engines.*—[Dated 28th November, 1859.]

This invention applies more particularly to steam-engines intended to work with a great degree of expansion of the steam in the cylinder, and consists in an improved method of imparting a variable motion to the slide-valve, so that the time of cutting off the steam may be regulated as required, without materially altering the time of admitting the steam into, or allowing it to escape from, the cylinder.

The apparatus is worked from the crank shaft of the engine by excentrics or other convenient means, to give motion to the link (used for working the slide-valve in connection with double excentrics) in the direction of its length, so as to cause it to quicken the motion of the valve at the time of shutting off the steam, and then cause the valve to move slower than its ordinary rate, so as to shut off the steam at any part of the stroke that may be required, without altering the time of opening the ports for its admission into, or its escape from, the cylinder; or the motion may be given to the sliding block, in order to effect the same object. By these means, the additional expansion valve ordinarily used may be dispensed with, while at the same time the steam will be shut off much closer to the cylinder, and thereby a greater economy of fuel effected (which will be particularly the case in quick-working engines and in oscillating engines, which ordinarily have long belt passages between the expansion and slide-valves), as the slide-jackets and passages will not be cooled by the steam being expanded down to a low temperature in them.

In Plate IV., fig. 1, shows a side elevation, and fig. 2, an end view, of the apparatus applied to a horizontal marine engine, with so much of the engine shown as will render the nature and action of the apparatus easy to be understood. *a*, is the link, with its sliding block *b*, giving motion to the side cross-head *c*. *d*, *d*, are the two excentrics and rods (one for the forward and one for the backward motion) fixed on the crank shaft *e*. *f*, is an additional excentric, which gives motion by its rod to the lever *g*, on the cross-shaft *h*. This lever has a sliding block moving in a slot, and which is adjusted by the screw and hand wheel *i*. On the end of the cross-shaft *h*, is another lever *k*, which vibrates equally on each side of its position as shown, so as to raise and lower the link *a*, by means of the counterbalance lever *l*, twice during each revolution of the engine. It will be readily seen that, supposing the sliding block *b*, to be moving in the direction shown by the arrow, for shutting off the steam, and the link to be then raised, the link will, by its inclined action, cause the block *b*, and consequently the slide-valve, to move more rapidly in the direction indicated, than it would do if actuated by its excentric alone, and so shut off the steam sooner; and then, if it be lowered again into its former position, it will cause the slide to move slower than its ordinary rate, so as to open the ports for the admission of the steam at the proper time.

To obtain the best result, the excentric *f*, should be fixed on the crank shaft, so that the lever *k*, may be in the centre of its travel, as shown, when the crank is within 10° of passing over its dead centre, or just before the piston arrives at the end of its stroke; and when so fixed, the steam may be cut off at any point from $\frac{1}{8}$ to $\frac{1}{2}$ of the stroke of the piston, without affecting the time of admitting the steam, or of allowing it to escape from the cylinder. The amount of expansion is regulated by the hand wheel and screw *i*, which adjusts the position of the sliding block in the lever *g*, so as to give a greater or less amount of lifting motion to the link; giving it more motion when required to work with a greater amount of expansion, or less when working with a less amount.

The ordinary starting and reversing gear is combined with the improved apparatus in the following manner:—The lever *g*, is shown working loose on the cross-shaft *h*, and the clutch *m*, is made to slide on feathers or keys, and may be thrown into gear, either with the lever *g*, or with the worm wheel *n*, which is also fitted loose on the cross-shaft, and which is worked by the starting wheel *o*, in the ordinary way. The worm-wheel *n*, may be made so as to allow the clutch *m*, to slide into gear with it in almost every position, while the lever *g*, must be made so that the clutch will slide into gear with it in one relative position only. On starting the engines, the clutch must be in gear with the worm-wheel *n*, and, if required to work expansively, it must be thrown out of gear with it, and into gear with the expansion lever *g*; and when again required to stop or reverse the engines, the clutch must be thrown out of gear with the expansion lever, and into gear with the worm-wheel, when the link may be raised by the hand wheel *o*, in the ordinary way.

The patentee claims, "the application of apparatus for imparting motion (in the direction of its length) to the link ordinarily used with double excentrics, or, *vice versâ*, to the sliding block, for the purpose of cutting off the steam by the slide-valve at any part of the stroke required, without altering the time of its admission, essentially as described."

To GEORGE TURNBULL, *of Calcutta, East Indies, for improvements in the permanent way of railways.*—[Dated 23rd February, 1859.]

THESE improvements in the permanent way of railways relate to the use of longitudinal sleepers of iron, to which the rails (whether bridge rails, or solid-headed rails) are fixed by screw-bolts and nuts. The horizontal upper surface of the longitudinal iron sleepers is made of a greater width than the widest part of the lower or under surface of the rails, which are to be fixed thereon; and the upper surface of the sleepers is rolled with a longitudinal groove, only slightly wider than the under surface of the rails, so that the rails are prevented moving laterally, at the same time greater strength (in using a given quantity of iron) is given to the edges of the sleepers beyond the rails. The whole width of the sleeper is rolled flat, so that it rests horizontally on the surface of the earth below. The sleepers are turned down at their edges at right angles to the upper horizontal surface. By thus making the upper surface of the sleepers wider than the greatest width of the rails, and by turning down the edges of the sleepers to a comparatively small extent at right angles, as described, great stability will be obtained when using a given weight of iron as compared with other forms of sleepers of iron, heretofore proposed. To preserve the gauge of the longitudinal sleepers, and the rails fixed thereon, transverse ties are used, which are fixed at intervals under the sleepers, by screw-bolts and nuts; these ties are flat at their upper surfaces, and they are turned down at right angles at their edges. The flanches or turned-down edges of the longitudinal sleepers or bearers are cut away where the ends of the transverse ties come under the sleepers or bearers.

In Plate IV., fig. 1, is a transverse section of a bridge rail, fixed to a longitudinal sleeper, formed according to this invention; and fig. 2, a side elevation of part of a rail and sleeper, where the under flanches, or downward projections on the under side of the sleeper, are removed, in order to fix the end of a transverse tie. *a, a,* is the rail; *b, b,* is the longitudinal sleeper, the under surface of which is formed flat to the extent of its whole width from b^*, b^*, and in use it rests in a horizontal position on the surface below; b^1, b^1, show the groove, or longitudinal recess formed in the upper surface; b^2, b^2, the edges of the longitudinal bearers or sleepers turned down at right angles; *c, c,* the screws and nuts by which the rails are fixed to the sleepers or bearers; *d,* a transverse tie of the form above described; and *e, e,* screw-bolts and nut by which it is fixed.

The patentee claims, "the constructing the permanent way of a railway with longitudinal sleepers or bearers, such as are herein described."

To CHARLES LEWIS ROBERTS, *of Clerkenwell, for improvements in cigars.*—[Dated 29th March, 1859.]

THIS invention, which has reference to improvements in cigars, with the view to render the same more agreeable, and the effects less pernicious to the smoker than hitherto, consists in enclosing within the ends of cigars during the manufacture, tubes or mouthpieces of glass, earthenware, wood, or other like material, provided with inner tubes or linings of straw, or other suitable absorbent substance, and so placed as to admit of one end being conveniently held within the mouth of the smoker, whilst the other is firmly embedded in the cigar.

The figure in Plate IV., represents a longitudinal section of the cigar, with its appendages. *a, a,* is the cigar; *b, b,* the tube or mouthpiece, formed of glass, wood, or other suitable material; *c, c,* the perforation through which the smoke is drawn into the mouth; *d, d,* a lip or flange, for enabling the cigar to be more conveniently held in the mouth of the smoker; *e, e,* the inner tube, or lining of straw or other absorbent substance; and *f, f,* a wrapper or label surrounding the cigar and mouthpiece.

The patentee claims, "the employment of tubes or mouthpieces, in connection with the straw or inner lining, in the manner and for the purposes described."

To JAMES RAE, *of Alpha-road, New Cross, for improvements in cisterns suitable for containing water for household uses.*—[Dated 11th November, 1858.]

THE improvements in cisterns, forming the subject of this invention, are shown in Plate IV., wherein fig. 1, is a transverse section of the cistern, having a bottom which inclines toward a central point (it may, however, have a curved bottom, or a bottom inclined from back to front); and fig. 2, is a vertical section of a filter to be placed in the interior of the cistern. *l,* is the supply-pipe of the cistern, the end of which is conducted down to near the bottom, and is turned round as is shown, so as to cause a circular motion in the cistern when the water enters by the pipe, which brings down the sediment to the bottom of the cistern; *k,* is a pipe, connected to the closets of the house, by which the sediment passes out of the cistern; *e,* is the filter; *h,* is a pipe furnished with a tap, by which filtered water may be drawn off; *g,* is the air-pipe of the filter; *m,* is a pipe furnished with a tap, by which unfiltered water may be drawn off: the end of this pipe may be protected as before explained. The filter shown at fig. 2, is constructed in the following manner:—It consists of a vessel of sheet metal *a,* having a perforated bottom, and is closed at the top, with the exception of a hole into which the sponge *b,* is placed: the vessel contains trays *c, c.* The top and bottom trays both contain sand, and the middle tray contains charcoal, or, for these, other filtering materials may be substituted. The trays are caused to fit tightly within the vessel *a,* by rings of vulcanized india-rubber. *d,* is an under vessel, into which the filtered water passes; it is furnished (in addition to the pipe already mentioned) with a pipe *o,* passing to the exterior of the cistern, and with a stop-cock, by which, from time to time, any sediment arising from the escape of the filtering materials may be drawn off. In the filter shown at fig. 1, the vessel *d,* is put on the top of the vessel *a,* and the water filters upwards into it.

To WALKER MOSELEY, *of New-street, Covent-garden, for improvements in fountain pens.*—[Dated 26th November, 1859.]

THE objects of this invention are to regulate the supply of ink in fountain pens, to increase the quantity held in the pen, and to prevent blotting when writing with them.

The figure in Plate IV., is a section of one of the improved penholders as it would appear when ready for use. Within the lower part of the tube *a*, which holds the ink receiver *b*, and securely attached thereto, is placed a cylindrical piece of hard india-rubber, wood, ivory, or other suitable hard substance *c*, with an opening formed around its outer edge, for the reception of the pen or nib; this piece is perforated in its centre lengthwise with a round hole, on each side of which a groove is cut for a flat piece of hard substance *d*, to travel in backward and forward; this travelling piece *d*, is provided at its lower extremity with a conical and tongue-shaped piece, the tongue itself being in close proximity to the pen or nib; or the tongue may be formed at its tip with two side pieces or lips *e*, for the purpose of supplying the back of the nib with ink, so that, upon taking up the pen after it has been out of use for a time, it will instantly mark. To the upper end of the cylindrical piece *c*, is secured the ink receiver *b*, the same being made of soft india-rubber; its upper end being attached to a screw *f*, on the head of which is placed the cap *g*, to lengthen the holder, but when out of use, it is slipped over the pen, as shown by the dotted lines. To fill this penholder with ink, it is merely necessary to turn the screw-head *f*, a few times to the left hand, when the soft india-rubber tube or receiver *b*, becomes twisted, and forces the air out; the travelling piece *d*, is then drawn down with the finger or thumb nail sufficiently to allow the ink to pass freely through the conical opening in the piece *c*, when, by turning the screw the reverse way, to release the receiver, and dipping the end of the holder into an ink bottle or stand at the same time, the india-rubber, on resuming its former tubular shape, will draw the ink into its interior, thus replenishing it as often as required. To raise the penholder, the travelling piece *d*, is to be slightly withdrawn, to allow the ink to pass the cone-shaped piece, and the finger pressed on the receiver *b*, through an opening made in the metal case at g^1, or a kind of button may be used instead.

The patentee claims, "supplying fountain pens with ink, and regulating that supply in the manner described and shown."

To JEAN BAPTISTE HENRI HONORÉ RAYMOND BARRE *and* JEAN BAPTISTE MARIE ERNEST BARRE, *both of Paris, for improvements in cutting out or engraving metals and their alloys.*—[Dated 5th September, 1859.]

THIS invention relates to the engraving of metals by a chemical process, and consists chiefly in covering (by the aid of printing) the parts to be left intact with a fatty or resinous body, impenetrable to nitric acid, and leaving bare the parts which are desired to be acted upon by the acid.

For example:—Suppose a design is to be produced on a plate of copper, the design is first drawn on a lithographic stone, and then inked with a suitable mordant or adhesive medium, composed of one part printer's mordant, and one part copal oil varnish, colored with black printer's ink. An impression is taken on paper, and, by the aid of a lithographic press or other pressure, transferred to the copper-plate. The paper is then removed, by slightly wetting the same, when the design will be found transferred to the copper-plate. The design thus transferred is to be powdered with a resinous or fatty substance, impenetrable to nitric acid. This is composed of four-fifth parts of a resinous substance, and one-fifth part of

wax, stearine, or other similar substance. The mixture is melted by heat, and, when cold, is ground on a glass slab, by means of a muller, and sifted. When the plate is powdered therewith, it must be dusted carefully with a badger brush, in order to remove the powder which may be upon those parts not covered with ink. In this state, the plate is heated in a stove, until the substance which covers the design adheres perfectly to the metal.

When it is desired only to obtain very light and fine engraving, the metallic plate is submitted to the acid without further powdering; but if, on the contrary, deep engraving is required, the plate must be withdrawn from the stove, and, whilst it is still warm, it is to be powdered over with a resinous substance only. It is then cleaned or dusted, as above described, and this powdering is to be repeated two or three times, according to the depth to which the engraving is desired. The plate must be heated after each powdering, in order that the resinous substance may adhere perfectly to the metal. When the plate is thus prepared, it is to be smeared on all sides, except where the design is, with resin and suet, mixed and melted together. It is then dried, and placed dry in a porcelain vessel, filled with a bath of nitric acid, to which nitrate of copper is added. While the plate is in its bath of acid, the progress of the engraving, which is developed by the power of the acid, must be attentively watched. When the plate is bitten to the required degree, it must be washed in a bath of potash, and is then ready for the market.

To reproduce the design on the metallic plate in relief, the subject is traced in black on the plate, and it is, consequently, the design which, in the bath, is protected from the acid; and, on the contrary, all that which is not part of the design is attacked by the acid.

For engraving convex or concave objects, in order to transfer the design from the proof, a small roller is employed to press the paper against the plate; and, with this exception, the process is as above described.

To engrave a salver of goldsmith's work, the ordinary leather tympan of the lithographic-press is replaced by smooth cardboard, well greased, which fits in the salver on which it is desired to transfer the design. Apart from this modification, the remainder of the process is the same as described in the preceding cases.

If, however, the designs in relief are required to be shaded by lines less deep, the operation is as follows:—Suppose that the design in relief presents a landscape, in which are placed some animals, the design is traced on a lithographic stone in such a manner that those parts shall be white which it is wished to obtain less deep, and all the rest of the stone is black. A proof of this design is taken on unsized paper, and transferred on to a plate of metal, which undergoes the successive operations described above. It is then submitted to the acid, which gives the design of the shading engraved similar to that which the lithographic stone bears. In order to complete the engraving, the same design is retraced on a second lithographic stone, but on which the animals, for example, are in outline only, without any shading, and so placed, that when the transfer thereof is made by means of the proof, they shall cover over all the lines of shading produced by the first part of the engraving above named. To obtain this result of exact super-position, it is indispensable to fix register-points on the two lithographic stones, on the two designs, and on the metallic plate.

A proof of this second part of the design is taken and transferred to the

plate of metal (taking care to "register" correctly, as above named) on which the lines for the shading are already engraved. The plate is then powdered over, and heated as often as may be necessary to obtain the lines of the engraving of the required strength, and subsequently submitted to the acids, by which it is acted on deeply, so that it may present, when the operation is finished, shading lines of less depth, according as desired.

When it is desired to perforate or cut through the metallic plates, the metal is left in contact with the acid until it is pierced or perforated completely through.

By this process of engraving and perforating metals, it is proposed to decorate gold and silver work and jewellery, whether real or imitative, seals, book-markers, and other plates for marking ciphers, armorial bearings, and other designs.

The patentees claim, "the system of engraving, cutting out, or perforating metals or alloys by means of the process above described, and especially the three operations of transferring the printed design on to the metal or alloy, powdering the same with a resinous and fatty substance, and biting away the uncovered portions by means of acid."

To RICHARD ARCHIBALD BROOMAN, *of Fleet-street, for improvements in the preparation of red coloring matters or dyes,—being a communication.*—[Dated 28th November, 1859.]

THIS invention consists in obtaining red coloring matters, by heating to boiling point, aniline, toluidine, cumidine, or xylidine, with one of the following salts, which should be used in a solid state, or with a mixture of two or more of them:—sulphates of tin, sulphates of mercury, bi-fluoride of tin, bi-fluoride of mercury, nitrate of uranium, nitrate of peroxide of iron, bi-chloride of litanium, bi-bromide (bi-bromure) of mercury, bi-bromide (bi-bromure) of tin, iodides of tin, chlorides of uranium, bromate of mercury. The inventor recommends eight parts by weight, of the aniline, toluidine, cumidine, or xylidine, and six parts by weight, of the above-named salts. The matter obtained is thinned down with boiling water, when required for dyeing, and the goods are dyed in the solution, in the ordinary manner. If a concentrated solution is sought, the matter is treated with alcohol, wood spirit, or acetic acid. The color becomes fixed upon silk and wool without a mordant, or with ordinary mordants, mineral acids excepted; but for being fixed on cotton, it is necessary that the cotton be first albuminized, or prepared with the oily preparation used for dyeing it Turkey red.

The patentee claims, "preparing red coloring matters or dyes, by means and in manner described."

To WILLIAM EDWARD NEWTON, *of* 66 *Chancery-lane, for improvements in machine belting or banding, and in the machinery and process of making the same,—being a communication.*—[Dated 29th December, 1859.]

THE first part of this invention relates to improvements in machinery for

the manufacture of the ordinary india-rubber or gutta-percha belting or banding.

In Plate IV., fig. 1, represents, in partial plan view, the improved machinery for manufacturing belting. Fig. 2, is a longitudinal vertical section of the same, taken through the centre of the machine. Figs. 3, and 4, are transverse vertical sections, taken respectively in the lines C, D, and E, F, fig. 1. *a, a,* is the framework of the machine; *b, b,* the sheet of wide rubber or gutta-percha, for forming the outside of the belt. While coated with cement, or in a sticky condition on one surface, it is wound, together with a cloth *c, c, c,* to prevent the adhesion of the surface, upon a supply roll *d,* and is fed along to two sets of revolving circular cutters *e, e, e, e,* which cut off from the wide sheet the necessary width to form the outside of the belt. These cutters are susceptible of lateral adjustment upon their shafts *f, f,* so that any desired width of strip can be cut. The remaining portion of the wide strip or sheet is wound up, as fast as the strip is cut off, upon a roller *g,* together with a sheet of cloth *h,* supplied from a roller *i.* *k,* is a roller, upon which is wound the sheet of rubber or gutta-percha, of which the inner portion or body of the belt is to be composed. This sheet is wound with a sheet of cloth *l,* between the layers, so as to prevent them from sticking together. The cloth *l,* is supplied from a roller *m,* and is fed along to two sets of revolving circular cutters *n, n, n, n,* which cut off the desired width of strip for the body of the belt. These cutters are also capable of lateral adjustment on their shafts *o, o.* The remaining portion of this sheet is then wound upon a roll *p,* together with a cloth *q.* The strips thus cut off, are now fed over rolls *r, r,*—the outside strip *b,* being the lower one; and from thence between two other rollers *s, s,* whereby the two strips are united, and caused to adhere together. The sheet, thus formed of the two strips, then passes between two rollers *u,* and *v,* the lower one *v,* having cams, as seen in the plan view fig. 1, and the cross section fig. 4, while the upper roller *u,* works between these cams, upon the upper surface of the belt. By these rollers, the belt is turned up into a gutter shape, and passed to a roller *x* (fig. 3), having two tapering surfaces and a thin circular disc *y,* which serve to complete the overlapping or covering of the inner strip by the outer one. The edges are then brought evenly together, so as to form a true and even joint, and at the same time the belt is formed by being drawn down, or cramped partly around the periphery of a roller *z*; the belt being passed down in nearly a vertical direction, and afterwards passing between two pressure rollers a^1, a^1. This mode of drawing the belts brings the edges of the lap or covering to a close even joint, with the greatest accuracy.

The object of the second improvement is to impart a smooth and finished surface to belts or bands, for the purpose of producing the best friction surface. To this end, the inventor takes a strip or sheet of india-rubber or gutta-percha, or of cloth covered with rubber or gutta-percha, and vulcanizes it, by subjecting it to a higher degree of heat than usual—say about 280°—for reasons to be hereinafter stated. The driving belt or band, having been made up in any proper manner previous to vulcanization, is then rolled tightly up with the previously vulcanized strip; and soapstone dust or black lead is to be sprinkled upon the same, to prevent the band and strip adhering together. The band is then vulcanized by placing the whole in a steam-boiler, or by subjecting it to a dry heat. By thus compressing the belt during the curing process, a smooth and finished

friction surface will be imparted to the belt. The reason for subjecting the strip with which the belt is wound to a somewhat higher heat than is usual, is that it shall not be liable to become tacky enough to adhere to the same. The desired effect may be also produced by extending the belt between straight strips or sheets of vulcanized rubber or gutta-percha, instead of rolling the strip and belt together.

Another mode of producing the same smooth friction surface, is to take a strip of cloth or paper having a smooth, polished, and enamelled surface (produced by coating it with a mixture of pipe-clay, soap-stone dust, or blacklead, and any suitable waterproof glue), and roll up the belt tightly with the strip, and proceed with the vulcanizing process.

The third improvement relates to the production of a new kind of belting and banding, and the machinery and process for forming the same. The centre of this belt is formed of a thick cotton fabric, woven of the intended width of the belt, and of different thicknesses, according to the strength required. For some small sizes, a fabric of the ordinary thickness of cotton duck will suffice, as it is much stronger, on account of the two selvages. For belts requiring greater strength, a thicker material may be used; and for the strongest, an article woven expressly for cotton belts, having a great thickness, should be employed. Both sides of the belt are to be covered with any composition of vulcanizable india-rubber or gutta-percha.

To cover the woven fabric on its sides and edges with a surface of india-rubber or gutta-percha, the machine shown in central section at fig. 5, is employed. In this figure, *a*, *a*, *a*, represents the supporting framework of the machine; *b*, *b*, and *c*, *c*, are large pressure rollers, revolving in opposite directions, between which the india-rubber or gutta-percha, in a soft state, and tolerably thick mass, is fed and rolled into a sheet; thence it passes around the lower pressure roller *c*, until the sheet comes in contact with a sheet of cotton duck or other woven fabric, fed from a supply roll *d*, and passing between the pressure roll *c*, and a lower roll *f*, whereby the entire surface of the woven fabric has the india-rubber ground and driven into it. The superfluous rubber or gutta-percha is then cut off by two cutters *g*, *g*, susceptible of lateral adjustment on their axles, so as to be adapted to different widths of belts. The belt, with its surface thus covered, is passed between rollers *h*, *h*, having portions of their peripheries cut away, so as to leave shoulders *i*, *i*, with slightly rounded edges, as seen in fig. 1. These press the edges of the rubber or gutta-percha firmly and evenly upon the edges of the woven fabric. The edges of the belt are then calendered, so as to form a smooth and even finish thereto, by being passed between two grooved wheels *k*, *k*. The vulcanization then completes the operation. The cutters *g*, *g*, can be made by stationary or revolving knives. The wheels *k*, *k*, are sometimes used before the belt is passed through the rollers *h*, *h*. It will be seen that the other side of the fabric can be coated in the same manner, by passing it again through the machine.

The last improvement relates to a machine for manufacturing the improved solid belting, by which the sides and edges of the fabric, comprising the inner portion of the belt, are encased in india-rubber or gutta-percha, at one operation, and also, by which any number of belts, of the same or of different widths, can be formed at a time. Fig. 6, represents a longitudinal vertical section of the machine; and figs. 7, and 8, are

detail sections of parts of the apparatus. *a, a, a,* represent the supporting framework of the machine. *b, b, c, c, d, d,* and *e, e,* are large pressure rollers, between which, respectively, the india-rubber or gutta-percha, in a soft state, is fed and rolled into a sheet; and after passing partially around the peripheries of the central pressing rollers *c, c,* and *d, d,* this sheet of rubber comes in contact with the woven fabric *f,* fed from a supply roll *g,* whereby the upper and lower surfaces of the woven fabric have the india-rubber or gutta-percha ground and driven into them. The belt, thus covered, then passes to two sets of circular formers *h, h,* of peculiar shape, as represented at fig. 7, and the rubber, being in a soft and plastic state, will take hold of the upper and under sheets, and press the same upon the edges of the woven fabric, thereby completely uniting the sheets, and covering the edges. To prevent the sheets of india-rubber from being cut off in passing through the formers, their peripheries are flattened, to allow the sheets of rubber or gutta-percha to pass between them. The belt then passes to a set of cutters *i, i, i, i,* which cut off such of the superfluous gum from the edges of the belt as may remain after the passage of the belt between the formers *h, h.* The edges of the belt are then smoothed by means of calender rolls *j, j,* having their peripheries so shaped as to conform with the edges of the belt; after which, the belt or band, passing partially around the guide roll *k,* is wound upon a suitable mandril *l.* The circular formers *h, h,* and cutters *i, i,* admit of being adjusted laterally upon a screw-shaft *m,* so as to adapt them to belts of different widths, by means of collars *n, n,* and nuts *o, o.* The calender rolls also admit of being set in any position, so as to correspond with different widths of belts, by means of a groove *p,* in which the shaft *q,* to which the calender rolls are attached, slide, and are secured by means of a screw, or in any other proper manner.

The patentee claims, "First,—The mode or modes herein set forth of manufacturing machine belting or banding; and, Secondly,—the improved machinery herein set forth, for making machine belting or banding."

To JOHN TALBOT PITMAN, *of Gracechurch-street, for an improved method of curing india-rubber or gutta-percha compounds,—being a communication.*—[Dated 21st November, 1859.]

THIS invention consists in the use of a metallic bath, so constituted as to fuse at or below the lowest degree of temperature required in vulcanization, and capable of being elevated readily to the highest temperature required in the process. Preparations of india-rubber and sulphur, or india-rubber combined with any vulcanizing agent, immersed in such a bath when at its fusing point, are thoroughly vulcanized in from two to five hours, according to the temperature maintained. Preparations of gutta-percha are similarly affected, and the process is equally adapted to the manufacture of soft and hard gutta-percha or india-rubber. The composition of the bath may be varied to meet any required case, but as it is more convenient to use one of a low fusing point, it will, perhaps, be well usually to make use of an alloy 50 parts of bismuth, 31 of lead, and 19 of tin, fusing at about 203° Fahr. When the articles to be vulcanized will bear a higher temperature than 212°, in the early stages of the process, a bath of higher fusing point may be used, and the above alloy may be

modified accordingly; it may be made less fusible by increasing the proportion of tin and lead, and by the addition of zinc or other metal. Mercury alone might be used as a bath, but would be expensive, and when used in an open vessel, objectionable, on account of the mercurial vapors that would be evolved. It may be used in small proportions, however, for the purpose of increasing the fusibility of alloys. The process can be conducted in any open iron vessel, and the temperature regulated by means of a thermometer inserted in the bath. The articles may, if desired, be transferred from one bath to another successively, in order to avoid the necessity of materially raising the temperature of a single bath. For instance, articles may be immersed in a bath ranging from 212° to 220° for one hour, for the purpose of expelling moisture, and commencing the process of vulcanization, and then transferred to another bath varying from 225° to 230°, and so continued until the highest desirable point of temperature has been reached. In the vulcanization of fine soft goods, it is preferred to raise the temperature of the bath only 225° during the first hour, and gradually to elevate it to 275° in five hours from the time of the first immersion. If the articles to be vulcanized are of a coarser quality, they may be vulcanized in two hours, by bringing up the temperature during that time to 300°.

The patentee claims, "the use of a metallic bath substantially as herein described, for the purposes of vulcanization."

To JOSEPH RANDALL PALMER, *of Newport-cottage, Old Ford, Bow, for improvements in the manufacture of printing ink, and paints and varnishes, and also in the manufacture of lacquers, japans, and blacking.*—[Dated 19th October, 1859.]

THIS invention consists in employing the residual black powder obtained when manufacturing lilac or purple colors from salts of aniline and such like substances, as described in the specification of a patent granted to W. H. Perkin, dated 26th August, 1856, or by other similar processes, in place of, or in combination with, lamp or ivory black, in the manufacture of printing ink, paints, and varnishes.

In this specification was described the obtaining a coloring matter from a solution of sulphate of aniline, and such like substances, by mixing therewith a solution of a soluble bichromate, by which means a black precipitate, containing the coloring matter is obtained. Now the present invention consists in employing this black precipitate after the brown impurities and the coloring matter have been dissolved from it, either alone or in combination with lamp or ivory black, in the manufacture of printing ink and paints and varnishes, and also in the manufacture of lacquers, japans, and blacking; by which means a much more intense black is obtained, and the brown shade all lamp blacks more or less possess is entirely overcome, thus giving a tone and brilliancy of appearance to the ordinary blacks not previously obtainable. In order to incorporate the black precipitate, which the patentee calls black chromium, with lamp black, the patentee takes about twenty-five per cent. of the black chromium, and about seventy-five per cent. of lamp black, and mixes them together, by preference, in a pulveriser, driven by steam power from a horizontal shaft, with a spur and a pinion wheel, which gives motion to

a vertical spindle, which passes through the under part of the pulveriser. Upon the end of this spindle a cross-head is fastened with arms turned downwards; these arms act upon two very large and finely turned iron balls, causing them to revolve round the bottom and part of the sides of the pulveriser, the inside of which is made as concave as the iron balls are convex. There are also inside of the machine two agitators which precede the course of the revolving balls, and which effectively present a fresh surface of color for the iron balls to act upon. The machine is fitted with a tight cover bolted on. In the centre of this cover a round hole is left, for the purpose of feeding the machine, which hole is fitted with a tight cover. At one side, and as close as possible to the bottom of the machine, there is an outlet for the black, when finished. This aperture is fitted with a wooden shoot and slide, to regulate the quantity required to be taken out. The mixed black is then taken to a sifting machine, which consists of four drum-shaped sieves, made of fine copper wire-gauze, the mesh of which is about 120 to the square inch. These sieves are fitted with tight drum heads, made of leather (to prevent any loss of the color); the sieves are caused to make a partial rotation on their axles, first in one direction and then in the other, by a crank working in a socket fixed in a frame, on which the sieves are laid and firmly held. This wooden frame is suspended by four straps, which are fixed to the four upright parts of the framework of the machine. Under each sieve is a receiver, made also of leather, and which is fitted on tightly, to prevent loss. Any particles of color remaining in the sieve, that will not pass through the meshes, are taken out and again put into the pulveriser. The black that passes through the sieves becomes a very fine powder, and it is then fitted to be used in place of lamp or ivory black in any of the manufactures hereinbefore mentioned.

The black chromium may also be prepared in a similar manner, by grinding and sifting, so as to be used by itself, in place of lamp or ivory black, in any of the manufactures before mentioned.

To Thomas Barnabas Daft, *of Tottenham, for an improvement in coating sheathing metal.*—[Dated 22nd November, 1859.]

This invention consists in coating Muntz's, or such like yellow metal sheathing, with india-rubber, combined with sulphur. For this purpose, the patentee takes sheets of Muntz's, or such like yellow metal, and having cleaned the surfaces by acids, and scoured them, so as to remove all scale or oxide, he places them, one by one, on a flat strong iron plate of suitable dimensions, interposing between each plate of yellow metal and the next plate a sheet of india-rubber compound, prepared with sulphur, as is well understood, for the purpose of vulcanization. Over each india-rubber sheet a sheet of tinned iron or zinc is placed, and then another plate of yellow metal, and so on, until a pile is made of from 50 to 100 sheets of yellow metal. On the top of this pile is placed another strong flat iron plate, similar to the bottom plate, and by means of bars, and bolts, and nuts, the pile is compressed as closely as possible together, forming, as nearly as practicable, a solid mass. This is now put into a steam chamber, and submitted, whilst under pressure, to the action of steam at from 40 to 60 lbs. on the inch, from 30 to 90 minutes, according to the degree of

vulcanization required, and according to the nature of the india-rubber compound used. In all cases, the pile is kept in the steam-chamber long enough to vulcanize the india-rubber compound, and by which time the same is found to have firmly adhered to the yellow metal. To cover sheets of iron, copper, or other metal, with india-rubber, they are first coated with Muntz's, or such like yellow metal, by any of the ordinary or well known processes, and then submitted to the operation above described. To cover Muntz's, or such like yellow metal, on both sides with india-rubber compound, a sheet of the india-rubber compound is first laid on a sheet of tin, tinned iron, or zinc, the latter being first placed on a strong flat iron plate; the yellow metal is then laid on the rubber, and then another sheet of india-rubber, and then a sheet of tin, and so on; each sheet of yellow metal being in contact on both sides with india-rubber, so that, when acted upon by steam and pressure, the vulcanization and adhesion will be found perfect. Sheathing metal, coated as above described, will be found to be much more durable than sheating metal not so coated.

To EDWARD THOMAS HUGHES, *of Chancery-lane, for improvements in the manufacture of a certain substance to supersede blasting powder,—being a communication.*—[Dated 23rd November, 1859.]

THIS substitute for blasting powder, called by the inventor alkal-oxide, is produced by saturation, by the disengagement of an acid gas from an alkaline solution in contact with a vegetable and mineral substance. The mixture consists of about eighty parts of carbonate of potash, thirty parts of ground straw, and fifteen parts of anthracite, dissolved in a sufficient quantity of water to form a thin paste, which mixture may be made or worked in Woulf's machine, or other suitable apparatus, and must be kept at a very moderate temperature.

To obtain the saturation of the said mixture, it is submitted to a current of acid gas, produced by the peroxide of manganese and hydrochloric acid, heated in a vessel, placed in another vessel, containing boiling water, commonly called a bath; the saturation is not to continue more than twelve hours; after which the mixture is withdrawn, and placed in ventilated drying ovens, or an ordinary heating or drying room. Care must be taken, during the process of saturation, to prevent the alkaline mixture from coming in contact with the atmospheric air. Or, instead of ground straw and anthracite, ordinary pit coal may be used, ground fine; this mixture to be made as in the case above described, with alkaline salts in solution, into which must be introduced a current of acid gas, produced as before stated, then dried and ground. This mixture may be used in a state of paste, blocks, or powder; if in the latter state, it may be passed very rapidly through a mill, after the drying operation has been completed. Common carbonate of potash may also be used, such as produced by the calcination of vegetables, or by drying and evaporating nitrates of soda until dry.

This improved substance may be used in the same manner as ordinary blasting powder, and in the same quantities, although its density is less, and danger of explosion entirely avoided; it burns slowly in the open air, and allows the gases to escape without any offensive smell or suffocating effects, which advantages are very great to operatives working in mines or

subterranean galleries: it only acquires its expansive powers by compression, or being confined; therefore, instead of projecting the mineral or material a great distance, it merely dilates or expands it, thus preventing serious accidents to which the workmen are exposed.

The patentee claims, "the mixture, combination, or amalgamation of the products or materials described, as a substitute for blasting powder, particularly applicable to stone quarries and similar purposes."

To EDWARD THOMAS HUGHES, *of Chancery-lane, for an improved chemical combination to supersede blasting powder,—being a communication.*—[Dated 23rd November, 1859.]

THIS invention for obtaining a substitute for blasting powder, called by the inventor oxygenic composition, consists in reducing to powder, either separately or combined, chlorate of potash, carbonic acid (charcoal), adding a little water, and mixing them to the consistency of paste, and then passing it through a mill or other apparatus suitable for grinding it; which operation must be continued until both substances are perfectly mixed; the paste must then be taken out of the mill and dried, either by fire, heat, steam, or air. Or the composition may be made by dissolving chlorate of potash in water, and introducing powdered coal; then evaporating the mixture, until it attains the consistency of a paste, and drying it as above described. Or the carbonic acid may be replaced by any kind of ground vegetable matter (especially wood), such as fir, beach, oak, or similar woods, by which a composition of great strength is obtained, without being explosive. The substances must be ground separately, and then mixed together in water strongly gummed. The proportions of the substances will vary, according to the strength required: but the average will be about 100 parts of ground vegetable matter or carbonic acid, to 200 parts of chlorate of potash. The last-mentioned combinations are best adapted for cartridges used in coal-mines and all underground work, in consequence of the little smoke they produce. If considered necessary, any required form can be given to the composition by spreading it before a drying apparatus, in beds or layers, and then dividing it, or shaping it in moulds, or other suitable means.

The patentee claims, "the employment of chlorate, and all productions which will have that salt for the base, mixed with combustible matters, tending to form similar combinations; and the use of such composition as a substitute for blasting powder in mines, and for other purposes where powder is necessary."

To WILLIAM KEATES, *of Liverpool, for an improved mode of manufacturing or forming the foundation or body of compound cylinders used for printing or embossing fabrics.*—[Dated 23rd November, 1859.]

HITHERTO the mode of making the foundation or body of compound cylinders has either been by forming a hollow tube, and inserting such tube, after its formation, into the shell of copper, or other metal, or alloy, forming the outer part of the cylinder; or by casting a hollow tube within such shell. The present improvement consists in taking a solid cylinder,

of suitable metal, and inserting it within the outer shell of copper, or other metal, or alloy, forming the printing or embossing surface. Or the said solid cylinder may be cast directly within the copper shell. A solid cylinder of one metal, within an outer shell of another, being thus obtained, the centre of the solid cylinder is bored out, to receive the printing mandril. The compound cylinder, thus formed, is made ready for the engraver, by all or any of the usual processes of hammering, rolling, drawing, turning, and polishing.

The patentee claims, "the formation of the foundation or body of compound rollers, from a solid cylinder or block of metal by the modes herein described, or any modification thereof."

To Thomas Watson *and* George Healey, *both of Rochdale, Lancashire, for certain improvements in the manufacture of silk velvets.*—[Dated 26th November, 1859.]

This invention relates to the application of a certain description of silk waste to the manufacture of silk velvets. This silk waste is known in the trade as "soft silk waste" and "hard silk waste," and is made from the windings of raw or thrown silk in its dyed or colored state, and from the weaving or manufacturing of raw silk goods, or by any process in which this class of waste arises, whether colored or uncolored. These descriptions of silk waste differ from ordinary kinds of silk waste known and used in the trade, such as throwsters' waste, "husks and knubbs," and all other sorts generally used for spinning purposes. The soft or hard silk waste is prepared and spun in the ordinary manner of preparing and spinning other kinds of silk waste, either in the length, without cutting, or cut. The spun waste is woven and manufactured into velvets, either plain or in fancy patterns, in the ordinary manner of weaving cotton velvets, or by any other method of weaving which produces a pile fabric known as silk velvet or silk plush. If required, any proportion of the said soft or hard silk waste may be mixed with the ordinary and before-named silk waste used for spinning purposes.

The patentees claim, "the novel application of certain description of silk waste to the manufacture of silk velvets, known as 'hard silk waste' and 'soft silk waste,' which has not been hitherto so employed, and whether in the colored or uncolored state, as described."

To Joseph Bower, *of Hunslet, Yorkshire, for an improved method of preparing clay for the manufacture of crucibles, pots, and earthenware.*—[Dated 28th November, 1859.]

The object of this invention is to purify the clay from which crucibles, pots, and earthenware are to be made, when such clay contains iron, lime, or magnesia, by removing these impurities from it, which is effected by first mixing with the clay an acid which will dissolve the iron, lime, or magnesia contained in it, and then washing out the dissolved impurities with water. Thus, the patentee takes a quantity of the clay to be purified, and having ascertained by analysis the proportions of iron, lime, or

magnesia which it contains, he mixes a corresponding quantity of muriatic acid, with enough water to more than saturate the clay, and having placed the clay in this solution, boils the whole in a cistern for about an hour; he then removes the dissolved impurities by repeated washings with water, until the wash waters become tasteless, or cease to throw down a precipitate on the addition of ammonia. The clay is then dried in the usual way, and is ready for use.

The patentee claims, "the method of purifying clay for the manufacture of crucibles, pots, and earthenware, by the employment of an acid which will dissolve the iron, lime, or magnesia contained therein, and by repeated washings, as described."

To CHARLES LAVERS SMITH, *of Highbury-crescent, for improvements in the preparation of certain coloring matters for dyeing, staining, and printing,—being a communication.*—[Dated 3rd December, 1859.]

THIS invention relates to an improved mode of treating aniline, toluidine, cumidine, or substances obtained from coal tar oils, or other analogous substances containing aniline, toluidine, or cumidine, for the purpose of producing therefrom a red color. Various chemical agents have hitherto been employed to effect this object, but the novelty of this invention consists in the use of iodine and its compounds. The development of the red color is effected by heating together, in different proportions, aniline or salts of aniline, or any of the analogous substances before mentioned, or the salts thereof, with metallic iodine, or iodine in combination with a metal, such as the bincodide of mercury. When metallic iodine is employed, the proportion preferred is two parts of aniline to one part of iodine, though more or less of this agent will develope the red color, in proportion to the quantity used.

When the bincodide of mercury, or iodine, in combination with other substances, is employed as the agent for developing the red color, a larger proportion of the binary compound must be employed than when metallic iodine is used. The mixture of the aniline and iodine, or iodine compound, is then heated and boiled in a glazed metallic digestor or other suitable vessel, until it passes through the various shades of brown and dull red, and attains a beautiful bright red color. This result may be facilitated by the addition of a small quantity of hydrochloric acid to the mixture. To obtain this color in a state fit for use, it should then be thrown into hot water, and boiled in different waters, until all or nearly all is dissolved. The solution should then be filtered, and the filtrate allowed to cool in suitable vessels, when the bulk of the coloring matter will be deposited. That which still remains in solution may then be precipitated by the addition of a proper quantity of common salt or other neutral salt. The precipitate thus obtained may then be dried or redissolved in methylated spirits of wine, for convenience of use; or the watery solutions first mentioned may be employed partially evaporated, or otherwise, for the purposes of dyeing, staining, or printing. The ordinary purple or violet coloring matter obtained from aniline or analogous substances, according to well known processes, whether patented or otherwise, may be converted into a red color by adding a small portion of pulverized metallic iodine, or

some iodide compound, such as the bincodide of mercury, the proportion of iodine or iodide compound to be added for this purpose must, of course, depend upon the strength of the purple or violet coloring matter.

The patentee claims, "producing a red color from aniline, toluidine, cumidine, or analogous substances, by treating them, or either of them, with iodine, or its compounds. Also, converting the ordinary purple or violet color obtained from aniline, toluidine, cumidine, or analogous substances into a red color, by the addition thereto of iodine or its compounds."

To William Christopher Maniece, *of Manchester, for improvements in cop tubes used in machinery for spinning fibrous substances.*—[Dated 24th November, 1859.]

This invention consists in constructing cop tubes of strips of prepared woven fabric. The fabric found hitherto to be the best adapted for the purpose is composed entirely of cotton, woven close, and prepared and finished by the application of a composition of flour, starch, china clay, or gypsum, and gelatine; such composition being thoroughly incorporated in the body of the fabric, by a subsequent process of calendering and beetling, to give stiffness and body to the fabric. This fabric is cut into segmental or straight taper strips, each of which will form a conical tube, more or less taper, when rolled up; and suitable cement is applied to secure the folds together in the form required, which operation may be performed either by hand, or by a similar machine to that usually employed to roll up strips of paper into cop tubes. In addition to the use of cement, and still further to secure the strips forming the tube, one or more metallic rivets is placed in each tube, passing through the folds forming the side of the tube. Tubes made according to or after the manner of this invention, are calculated to endure the usage to which cop tubes are subjected, for a longer period than cop tubes formed of paper or other similar material.

The patentee claims, "constructing cop tubes of strips of woven fabric prepared with a composition of flour, starch, china clay or gypsum, and gelatine; being subsequently finished by beetling or calendering, and rolled up into the form required, either by hand or by any suitable and ordinary machinery."

To Caleb Bedells, *of Leicester, for improvements in the manufacture of shoes and boots, and in fabrics suitable for use in this manufacture.*—[Dated 26th November, 1859.]

In making shoes and boots according to this invention, the patentee forms the uppers of a compound fabric, consisting of three fabrics, cemented together, viz., first, an outer surface, usually a woven fabric, of ornamental appearance; second, a thick non-elastic fabric, to give body to the compound; and, third, a lining, suitable for forming the interior of the upper of the shoe or boot; and in the process of manufacturing the compound fabric, a finish is made to the edges, at the parts where, in the finished shoe or boot, the edges would appear, by turning the edges of the outer fabric over the centre, or body fabric, and cementing them down; a cord being run in where the outer fabric is turned over, to give a fullness to the edge. The following is the manner of proceeding:—For the outer, or

face fabric, a suitable ornamental fabric—for example, a printed woollen fabric or velvet, or it may be a plain woollen cloth, or thin leather—is selected. For the body fabric, a thick holland or sail-cloth is employed; and for the lining fabric, a white calico or other similar material. These fabrics are coated with india-rubber cement, while in the piece; the face fabric and the lining being coated at the back only, and the body fabric on both sides. From these fabrics are cut pieces suitable to form the upper of a shoe, or boot. The upper is made in two parts—one to form the front, and the other to pass along the sides, and behind the heel. The patentee applies the three pieces to form one or other part of the upper and cuts one from each description of fabric, the one to the other, so as to produce a compound fabric; and along such of the edges of the upper as in the ordinary shoe or boot would be bound, he causes the face fabric to project beyond the body fabric, and folds this projecting edge over the edge of the body fabric, pressing it down, so as to cause the cement on the edge of the face fabric to adhere to that on the body fabric; the lining fabric being cut a little smaller than the body fabric, that the two may come together. In some cases, the body fabric is used round the heel part only, the edge of the face fabric being turned over the lining fabric, which, in this case, is coated at the edge with cement; the width of the turnover, or the lining, may be cut, so as to allow the face to turn over just to meet the lining edge. In order to thicken the edge, a cemented cord is enclosed in the bend or fold of the face. For the purpose of ventilating the shoe or boot, the materials of which the uppers are made are perforated with small points. In the process also of manufacturing the fabric, to form the portion of the upper which passes along the sides of the foot, and behind the heel, stiffening pieces of sailcloth are laid in, at intervals, between the body fabric and the lining, to give the necessary stiffness at the heel of the shoe or boot. In some cases, the uppers of shoes and boots are cut from a compound fabric, such as above described. In some cases, the patentee constructs uppers for shoes without a seam; he then cuts out the outer fabric, the body fabric, and the lining separately, and afterwards cements them together. The outer fabric is cut out somewhat smaller than the body fabric, so that the latter projects beyond the former, and the edges of the body fabric are covered, by cementing to it a suitable binding, by preference, formed from the piece cut out in forming the outer fabric of the upper of a shoe of a different color. When the upper of a shoe is made in one piece (with a single seam at the back), it will be seen that its form will be such, that pieces of fabric of considerable size are required to be cut out between the parts forming the two sides of the upper: the pieces thus cut out of the face fabric are made into binding strips. When such binding strips are to be used, the face fabric of the upper to be bound is so cut that the body fabric projects beyond it, along the edges to be bound, and the body fabric also projects beyond the lining fabric; the binding is bent over the edge in the usual manner, and its cemented side made to adhere to the cement on the body fabric.

In constructing shoes and boots of fabrics prepared as above described, the parts of the upper are cut out to the usual form, and sewn together in the usual manner; the upper is then put on a last, to which an inner or lining sole of thick paper or suitable material has previously been attached. The lower edges of the upper are then drawn over the edges of

the inner or lining sole, and the two are cemented together; the inner sole is cemented on its under side, or on the side which does not come in contact with the last before being placed upon it, and the edges of the body fabric of the upper, which, as before mentioned, it is preferred should project beyond the face fabric, are lapped over, and pressed on to the sole, to which they then firmly adhere.

Lastly, the true sole of the shoe or boot is also attached by means of cement, and the lower edges of the upper are then enclosed between the inner or binding sole and the true sole. This latter sole may be constructed from a form made, by preference, of several thicknesses of woven fabric cemented together; or it may be of other stiff material, covered with cloth or suitable woven fabric, thin leather, or gutta-percha; the edges of the covering material being turned over the edges of the form, and secured by cement. Cement is applied to the sole, to attach it to the inner or lining sole, and it is caused to adhere, by pressure, to the inner sole, and to the edges of the upper, which are also cemented. To attach a sole of thick leather to a shoe or boot constructed as before explained, the edge of the leather sole is perforated all round, and the perforations filled with gutta-percha. Perforations are also made in the lower edges of the upper, and the edges of the in-sole, and filled with gutta-percha; the sole is then applied, and the gutta-percha being warm, a complete adhesion is obtained; this system may also be applied in attaching soles of other materials.

The sole is finished by cementing a surface of thin leather to the under side of the sole, and a lining of the ordinary description to the upper surface of the sole within the shoe or boot. In place of pressing plastic gutta-percha into the holes formed in the sole and upper, as above described, it may be convenient to use short pieces of gutta-percha cord, of suitable thickness, and bent to this form ⊔. Each such piece passes through two holes in the sole, and the corresponding holes in the upper, to the interior of the shoe or boot; and a cemented line, made hot on a heated plate, is then introduced, and pressed down upon the points of the pieces of gutta-percha cord, which it flattens down, and so fixes the sole securely on. The last is made with a groove round the edge, so as to admit of the projecting ends of the gutta-percha cord. A surface of thin leather may be cemented to the under side of the sole as before, to hide the gutta-percha and the perforations.

Scientific Notices.

INSTITUTION OF MECHANICAL ENGINEERS.

Continued from page 47.

"*Description of Fryer's apparatus for filling locomotive tenders with water,*" by Mr. JAMES FENTON, of Low Moor.

DR. PAPIN, the celebrated French precursor of the many inventions connected with modern steam power, demonstrated as early as the year 1700, the practicability of raising water by the direct action of steam pressure

on its surface; and this system is still adopted with complete success for raising saccharine fluids in most sugar houses throughout the world. The method of filling locomotive tenders with water, where the supply is below the level of the railway, recently invented by Mr. Alfred Fryer, of Manchester, and forming the subject of the present paper, is, in fact, an adaptation of Dr. Papin's simple contrivance of 160 years ago.

The apparatus consists of a wrought-iron cylinder of 1500 or 2000 gallons capacity, placed upright beneath the surface of the supply water, which may be from 10 to 120 feet below the level of the railway. To reduce the amount of condensation, the cylinder is surrounded with brickwork, and a space of 2 inches between the brickwork and the cylinder is filled with clay, to prevent any water from getting to the outside of the cylinder. The cylinder contains a wrought-iron float, fitting it easily, and sliding on a centre guide-rod. The supply water enters through a self-acting inlet valve, of about 75 square inches area, at the top of the cylinder, and it is discharged from the bottom of the cylinder through a pipe leading to the engine water-crane. A steam pipe is attached to the top of the cylinder, leading to two pillars, placed a few yards distant on each side of the crane, and near the line of rails, and provided with flexible pipes, having bayonet joints for coupling to the locomotive boiler. When a tender is drawn up to be filled, the engine-driver couples one of the flexible pipes to the boiler, and turns on the steam, which, passing into the water cylinder, presses on the float, and forces the water up through the crane into the tender with great rapidity.

To prevent the steam now contained in the upper part of the cylinder from blowing out violently into the atmosphere when the flexible pipe is disconnected, a valve is placed in the top of the pillars, opening inwards, which allows a free passage for the steam to enter the cylinder; but when the pipe is uncoupled, the steam can only escape slowly through a small hole drilled in the valve. A hanging valve is placed between the two branches of the steam pipe, which prevents the steam entering through one of the pillars, from blowing out direct through the other, instead of passing down into the cylinder. As the steam escapes from the cylinder, a fresh supply of water enters it through the inlet valve, the cylinder being placed below the surface of the supply water. This valve is contained within a well, and the supply water is admitted through a valve and grating, by which it can be stopped back out of the well at any time, for the purpose of examining the inlet valve; or the valve itself can be detached and drawn up to the top of thewell, being slidden down to its place upon guide-rods, and secured by long screwed bolts that can be reached from the surface. The float is strengthened against collapsing by circular stays; and a small tube is inserted in it, reaching almost to the bottom, so that if any water should get into the interior of the float through a defective joint, it is expelled through the tube as soon as the pressure of steam is removed from the outside of the float, after filling a tender.

The apparatus is equally applicable when the supply of water is obtained from a reservoir at the foot of an embankment, from a well considerably below the level of the ground, or from running water.

In this plan of raising water by the direct action of steam pressure, it might be expected that the condensation of steam in the water cylinder would be so considerable, as to interfere seriously with the working of the apparatus; but it must be borne in mind that the larger the cylinder, the

smaller is the extent of surface presented for condensation, in proportion to its contents; and it has been proved by experiment, that this is not a serious objection in the size of the present apparatus; while the friction and waste of power involved with the pumps and engines now in use are obviously saved. In order to ascertain whether a locomotive boiler can afford to lose the amount of steam requisite to raise the water, especially where the lift is from 50 to 60 feet high, a boiler has been constructed of 141 gallons capacity, 69 per cent. of which was filled with water, connected by a flexible tube with a water cylinder, holding 131 gallons,—the arrangement being in all respects similar to that already described; the discharge water pipe from the cylinder rose 60 feet perpendicularly, but had valves at various lower elevations. The water pipe was 4 inches diameter inside, and the steam pipe 1¼ inch diameter, and the area of steam way in the tap 1·83 square inch. Many trials were made, in each of which 131 gallons of water were raised; the average height of lift being 52 feet, and the average pressure of steam in the boiler 56½ lbs. per square inch. In order to guard against too rapid a generation of steam, and to approximate to the condition of a locomotive when standing at a station, the damper remained closed during each trial. It was then found that the loss of steam pressure in raising the 131 gallons of water 52 feet high, was only 4·2 lbs. per square inch, and the time required, 32 seconds. When the damper remained open, the steam was generated more rapidly than it was used, and the pressure then rose during each trial. Hence a locomotive just arrived at a station will always have sufficient steam to spare to refill the tender; and this will consequently be effected at the entire saving of the pumping engines, pumps, and buildings at present necessary, while the heavy expenses now incurred of attendance, repairs, and fuel, are dispensed with.

With this apparatus, there is no difficulty in working during frost; the crane and pipes being kept always empty, and the water cylinder below the ice—thus removing the danger of the pipes bursting, and obviating the necessity of keeping them thawed by the application of fires, as in the case of the present water cranes. This is a consideration of no little importance, especially in Canada and other countries subject to severe and protracted frosts. The steam that is condensed in forcing up the water is not entirely lost, as it serves slightly to warm the water which will shortly supply the boiler. It has been computed that the cost in fuel of raising 1000 gallons of water 50 feet high, by this process, is less than one halfpenny; and the plan is therefore recommended by economy, great simplicity, and rapidity of action.

Mr. A. Fryer said, he had been led to this plan by difficulties experienced in raising continually large quantities of saccharine fluids, of a specific gravity of about 1·3, which had to be raised a height of 60 feet, to the top of the sugar manufactory. Cranes were previously used to lift the bags of rough sugar to the top of the building, but this was found to be a slow and expensive process when a large amount had to be conveyed, and pumps were then employed for the purpose; the first process of dissolving the sugar in hot water being performed at the bottom of the building, and the liquid then pumped up to the top; but the pumps were found to be rapidly worn and cut by the large quantity of sand, pieces of cane, and other rubbish that was mixed with the rough sugar, and no form of pump was able

to stand the work. He then tried the direct application of the steam pressure to force up the liquid through a pipe, and found it so completely successful, that the plan was adopted for the whole of the work. The dissolved sugar was put in a large close vessel, like a circular boiler, 6 feet diameter, with a delivery pipe 4 inches diameter, extending from it to the top of the building, a height of 60 feet; and steam at 40 lbs. per inch pressure was let into the upper part of the vessel, and, pressing upon the surface of the liquid, forced it instantly up the delivery pipe, the lower end of which reached to the bottom of the vessel inside. The process was effected with great rapidity, the solid refuse lying at the bottom of the vessel being swept clean out, together with the liquid. A quantity of 20,000 gallons per day was regularly raised in this way, and the solid matter carried up besides amounted to several tons per day. The vessel was recharged by condensing the steam in it, by a jet of cold water upon the outside, and opening a communication with the vat in which the sugar was dissolved; the vessel then became rapidly filled, and the process of letting in the steam and expelling the contents up the delivery pipe was directly repeated. There was found to be but little waste of steam in this process, although no float was used in the vessel, and the steam was admitted direct upon the surface of the liquid; for a film of boiling water was immediately formed upon the surface of the liquid, by the condensation of a small portion of the steam, which acted effectually as a non-conducting diaphragm, cutting off the communication with the colder liquid below, since there was no circulation to convey the heat downwards.

He had also made a trial of the same plan for raising water from a well 65 feet deep upon the works, in which the pump was sometimes under water, so that the valves could not be reached for repairs, and the pump was consequently stopped working; and he had succeeded in raising 100,000 gallons of water per day from the well, by that means. In this case, the rising main from the pumps, which was 18 inches diameter, had a second pipe, 4 inches diameter, inserted within it, extending nearly to the bottom, and having a valve at the bottom opening upwards; the space between the two pipes was closed at the top with a steam-tight joint, and steam of 40 lbs. pressure was admitted to it from an adjoining boiler. This steam expelled the water from the space between the pipes, driving it up the centre pipe; and on shutting off the steam, a fresh supply of water entered this space by condensation of the steam, and was again expelled up the centre pipe by repeating the process.

In order to ascertain, whether, in the case of filling locomotive tenders, there would be any risk of difficulty, from want of sufficient steam in the engine boiler, to serve for raising the water, he had tried some experiments with a small boiler disconnected from any other work, raising the water by the steam pressure, from a close vessel up a vertical stand pipe, which had cocks fixed into the side at different levels, that could be opened successively for discharging the water. He found that the water was discharged at 60 feet height, with a pressure of steam in the boiler of 27 lbs. per square inch, which was only slightly above the pressure required to balance the column of water. The quantity of steam required, was found to be so small, that a supply of water, sufficient to fill a locomotive tender, was easily raised with the boiler fire checked and the damper kept closed, to correspond with the condition of a locomotive standing at a station. In applying this plan for filling tenders, his object was to employ the power

available in the locomotive engine, for raising the water direct, instead of requiring the erection of fixed pumping machinery and engine power at each station.

It was thought that the plan possessed many advantages. It had great simplicity, and was free from liability to derangement from frost; the saving also in first cost would be very considerable, where stationary engines had now to be employed for pumping.

"*On the construction and durability of steam-boilers*," by Mr. BENJAMIN GOODFELLOW, of Hyde.

THE object of this paper is to communicate some circumstances and changes that have been observed by the writer to take place in the size and form of boilers at different temperatures, which affect considerably their strength and durability, by causing derangement and wear and tear to a much greater extent than he believes is generally supposed. His attention was first strongly drawn to this subject some years ago in reference to a large multitubular boiler that he constructed, 23 feet long and 6½ feet diameter, with 131 tubes, 11 feet long and 3 inches diameter each; and two similar boilers, but of smaller dimensions, with 9 feet tubes. A short time after these had been put to work, it was found that several of the tubes began to leak at both ends, although they had previously been proved up to 120 lbs. per square inch with water pressure, when all was good and tight, and the steam pressure they worked at was only from 50 to 55 lbs. After this leakage had been made good, it took place again in a few weeks; and this was repeated several times, both in the large and small boilers, but not to the same extent in the small ones. This led the writer to conclude that the cause was the elongation of the tubes by their being heated to a greater extent than the casing of the boiler; and this defect appears to him a serious objection in multitubular boilers with straight tubes of considerable length.

In the construction of fluid boilers of considerable length, say from 20 to 36 feet long, the writer at first adopted the plan of increasing the diameter of the flue, so as to increase the heating surface and diminish the quantity of water; bringing the flues nearer to each other, in the case of the two-flued boiler, and closer to the sides of the boiler, by making their diameter as large as could be got in. After a number of these had been got to work, several of them gave way transversely about the middle seam at the bottom, especially in cases where the boiler had been blown off for cleaning and cold water then turned in to cool it; the effect of which was that the bottom of the boiler instantly contracted in length, while the flues retained the same length, or nearly so, as when working, until the water came in contact with them, thereby necessarily throwing a great and undue strain upon every seam of the boiler, especially on the lower side, in consequence of the flues being so near the bottom of the boiler. The writer therefore concluded that it was wrong to increase the diameter of the ends of the flues, as this rendered the ends of the boiler much more rigid and less yielding to the expansion and contraction of the flues and casing, which do not take place in both simultaneously or to the same extent. In a boiler 30 feet long, the actual expansion of the barrel of the boiler amounts to nearly 1 inch in length; and when fired in the flue, the

latter is elongated ¼ inch more than the casing, in consequence of its being at so much higher a temperature. The evil effects of this expansion and contraction are further augmented by the ordinary use of gusset stays, by which the ends of the boiler are stiffened and rigidly connected to the barrel. The circumstance of the boilers giving way in the middle of their length, rather than in any other part, was owing, in the writer's opinion, to their being supported on a longitudinal centre wall, which divided the flues, or on two walls; when full of water, the boiler would weigh from 38 to 40 tons, and consequently there would be a great friction on the wall when the boiler was contracting; and the strain thus produced in pulling the two ends of the boiler nearer together is concentrated at the middle of its length, in addition to the strain arising from the resistance occasioned by the rigidity of the flues and gusset stays.

In order to obviate these difficulties in flued boilers, and to provide for expansion and contraction taking place without much injury to the material or workmanship, the writer has been led to adopt flues with tapered ends, which give a greater amount of elasticity to the ends of the boiler; and with the same view, the gusset stays are dispensed with, so that the ends are not connected in any way with the casing, except by an angle-iron ring that unites the two together. The same plan may be carried out in a single-flued boiler, either by tapering the ends of the flue, or plac- it nearer the centre of the boiler. The ends of the boiler are strengthened independently by means of T iron or "fish-back" girders rivetted on each end between the casing and the flues; and there are no longitudinal stays between the two ends beyond those supplied by the flues and casing, each end plate being treated as an independent transverse girder supported round its edge. In order to strengthen the bottom of the boiler at the middle, against the strain produced in contracting by the friction of the longitudinal walls on which it is supported, two longitudinal strips of angle iron or T iron are rivetted on the inside, at about 3 feet apart, extending about two-thirds the length of the boiler. The writer has also adopted for some time a plan of strengthening flues of large diameter against collapse, by means of rings of T iron or angle iron, rivetted at suitable intervals round the outside of the flue at the joints. In these joints the two ends of the boiler plates are not brought together, but are left with a space between them equal to the thickness of the outer rib of the T iron, whereby a joint is obtained having no greater thickness of metal than a double plate at any part.

The absence of longitudinal and gusset stays in this construction of boiler does not leave the ends less strong to resist explosion than the other parts of the casing: for taking the whole circumference of both flues and casing, the sectional area of plate resisting the pressure on the ends of the boiler is 4¾ times greater than that resisting the lateral pressure in the casing; and in the upper half of the ends, where the pressure acts upon the greatest proportionate area, producing the greatest longitudinal tension, the resistance is 3½ times that offered to lateral explosion; while in the lower half of the ends, where there is the least proportionate area for the pressure to act upon, the resistance is 6½ times greater than the lateral resistance. The fact that flued boilers generally explode endways, by failure of the lower part of the ends or casing—the very part which has been seen to be originally the strongest—proves that the strength of the plates at that part becomes greatly injured by the excessive strains arising from

unequal expansion and contraction of the flues and the casing of the boiler.

Mr. R. B. Longridge could confirm the observations made in the paper as to the frequent injury caused to boilers by the effects of unequal strains upon different portions; but he did not agree with the opinion expressed that the construction of boiler proposed would be free from this source of injury. There was no doubt that great mischief arose in many boilers from imperfect circulation of the water. If perfect circulation could be obtained, a uniform temperature throughout the boiler would be preserved, and these evils obviated. In two-flued boilers, generally, it was a great defect that the water spaces were made exceedingly small, and the descent of the water past them was opposed by the rising current from the heated sides of the flues; so that the only place where the water could descend was at the back end, where coolest; and in a boiler of 30 feet length this downward current was not able to reach the front end. Plates had been put into the boiler sometimes, to divert the currents of water, and cause more regularity of circulation, but he doubted whether with much success. When a couple of 3 feet flues were put into a 7 feet boiler, 3 inch water spaces only could be obtained; and although there was no doubt a better combustion in a large flue, yet this involved the sacrifice of the proper width of water space for ensuring due circulation in the boiler, which was a point of greater importance.

He did not agree with the mode proposed for staying boilers, and did not think it was at all advisable to dispense with both longitudinal and gusset stays; he considered that the end should not be left dependent only upon the rivetting to the cylindrical shell and the flues. The girder ends of the boiler would no doubt be strong enough so long as the flues held good; but if the flues got seriously overheated at any part, and fracture ensued, which was an accident that could not be absolutely guarded against, the boiler end might then give way on losing the support of the flues. In the case of boilers set upon a centre bearing wall, he did not see how the friction upon the bearing could cause such strain in expanding and contracting as sensibly to affect the durability of the plates; but the best plan of setting such boilers he considered was to support them upon cast-iron saddles, in such a manner as not to be dependent for support on the brickwork forming the flues. An objectionable action was caused when the fire was not placed in the boiler flues, but below the boiler, for in that case there was a continued current rising at the sides, causing a descending current in the middle between the two flues, which made the deposit all accumulate in the triangular space between the flues and immediately over the fire: in many such cases, the plates over the fire became overheated in consequence, and fractured or strained at the joints.

Mr. Goodfellow considered the mode of fixing boilers on cast-iron saddles was very good, and preferred it where a centre wall was not required for division between the flues. In respect of securing the boiler ends, he remembered a case where the end plates were increased from $\frac{1}{2}$ to $\frac{3}{4}$ inch thickness, on account of the boiler leaking at the ends; but the bottom had then torn asunder, and he had suggested tapering the ends of the flues to a smaller diameter, so as to increase the area of flat plate at the boiler end, and substituting a thinner plate, for the purpose of getting

more elastic action in the end plate: this had entirely removed the difficulty, and the boiler had continued at work for 1½ years since then, without any failure. He had found, by carefully measuring the end of a two-flued boiler, 28 feet long, that the front end plate was pushed outwards ⅛ inch in the centre, making it convex, each time the steam was up, and it gradually came back again on the boiler cooling: the back end of the boiler was not accessible for measurement, being within the brickwork, but both ends must have sprung nearly alike in order to cause the bulging, making altogether ¼ inch alternation in length of the flue, constantly going on in the working of the boiler. It appeared to him, then, that as this action could not be prevented, it was the best course to allow the end plates to yield to it, by leaving them elastic, and not hindering them from springing.

Mr. H. W. Harman said, that from his experience as chief inspector to the Manchester Association for the prevention of boiler explosions, he knew of no better construction than the cylindrical two-flued boiler, which was the one in most general use; but it was undoubtedly subject to the derangements pointed out in the paper, from the effects of unequal expansion and contraction. An unequal strain was caused upon the end angle iron of the boiler from the flues being attached to the end plate so much below the centre; he had found many fractures of the end plates immediately over the angle irons of the internal flues, caused principally by the end plates not yielding sufficiently to the elongation of the flues. There was no doubt that, if the plate were held too rigidly by gusset stays, something would have to give way to the inevitable strain from expansion; but he could not agree at all with the plan proposed of dispensing altogether with gusset and longitudinal stays. The entire omission of stays would be the opposite extreme, and he thought they ought not to be abandoned without substituting something else; the angle iron which would then form the only tie between the end plate and shell was unavoidably a comparatively weak form of iron, from the mode of its rolling, and he feared, if such a plan were adopted, great risk of accident from inferior quality of angle iron would ensue. He had examined boilers that had exploded, in which the whole of the angle iron had parted along the upper portion of the boiler end.

As to the strain along the bottom of the shell, he had found the addition of T iron strips along the bottom did not prevent this, and he believed it arose entirely from want of circulation in the water. The plan of a centre wall dividing the flue, with the boiler resting upon it, he considered objectionable; for any leakage of water trickled down to that point, and was absorbed by the centre wall like a sponge, acting as a constant source of corrosion to the boiler.

Imperfect circulation of water formed, he believed, the most serious defect in boilers; and in many of the two-flued boilers this was chiefly owing to their not having a sufficient water space between the flues and shell. He had long been convinced of the importance of ensuring a much better circulation of water being regularly maintained in boilers; and he contemplated effecting this by direct mechanical means.

Mr. D. Adamson thought it was certainly advisable to have the gusset stays for support to the end plates of a boiler, and he did not see that anything could be gained by transferring all the action to one joint; but, on the contrary, there was this important disadvantage to be considered—that if a plate were bent backwards and forwards continually, it might fail ulti-

mately, though not subjected at any one time to too severe a strain; if all the buckling action were thrown on the end plate, it would be simply a question of time as to its ultimate failure. On that account, he thought gusset stays should not be abandoned, and they served also as a good support against collapse; he should also recommend longitudinal stays to be retained in addition, for relieving the strain upon the boiler end joints and the circular seams of the boiler shell.

The Chairman said, he had two-flued boilers at his works, that had been in constant use for fifteen years, and no repairs had been wanted to them yet, and he had found them completely satisfactory; but then he never used angle iron in the construction of such boilers, considering there was not space enough for the plate to spring with the additional thickness of the angle iron. The plates of the shell, and the flues, were all flanged over at the ends for rivetting to the end plates, requiring, of course, best material for the plates; the water spaces he made never less than 6 inches, and preferred 8 inches; this construction gave great flexibility to the ends of the boiler, and there was no danger of failure, he believed, until the boiler was actually worn out with age.

The following paper was next read, "*On increased break power for stopping railway trains*," by Mr. ALEXANDER ALLEN, of Perth.

THE subject of increased break power, for stopping quick trains in a shorter distance than is at present practicable, has become of great importance, and the attention of railway companies has recently been specially drawn to it by the railway department of the Board of Trade, by whom a number of experiments were tried on breaks of engines and carriages; and a recommendation was made to the railway companies for carrying out a system of continuous breaks to the whole train. The subject was also recently under the consideration of a committee of the House of Commons, before whom evidence was given on the causes of railway accidents; this evidence was in favour of increased break power on the engine, if not too suddenly applied; for it was shown that no break on the carriages could be applied quickly enough to prevent accidents.

The subject of this paper is a plan for obtaining increased break power, by retarding the speed of the engine by means of a throttle-valve placed in the exhaust-pipe, which can be instantly closed to any required extent, so as to obstruct the exit of the steam from the cylinders, the regulator remaining open; at the same time the exhaust steam is admitted to a small cylinder, the piston of which acts through levers upon a break on the engine wheels.

In this arrangement, the spindle of the throttle-valve projects through the side of the smoke-box, and is worked from the foot-plate by means of a lever and connecting-rod. The break cylinder is 8 to 10 inches diameter. The exhaust steam is admitted into the bottom of the cylinder through a $1\frac{1}{4}$ inch pipe, provided with a cock, and, acting on the the underside of the piston, lifts the break lever and presses the break blocks against the wheels. The cock in the $1\frac{1}{4}$ inch pipe is worked from the foot-plate, by means of a lever turning loose on the spindle of the throttle-valve; the throttle-valve can thus be closed, without at the same time admitting the exhaust steam to the break cylinder, while the latter can also be instantly applied in cases of sudden emergency. When the steam pressure is removed from the

cylinder, the weight of the pison and lever draws the break blocks back clear of the wheels; the break cylinder being contiguous to the smoke-box, and the pipe leading to it short and open to the heat in the exhaust pipe, there is no risk of water accumulating in the cylinder to prevent the descent of the piston when the steam pressure is removed. The break blocks being under the charge of the engineman and fireman, will be regularly adjusted by them.

The break cylinder applies the breaks simultaneously to the leading and trailing wheels of the engine, and the driving wheels are at the same time retarded by the back pressure of the exhaust steam on the pistons, consequent upon the closing of the throttle-valve in the exhaust pipe; the pressure of steam in the break cylinder is the same as the back pressure in the driving cylinders, both being regulated by the extent of closing of the throttle-valve. The power of the break cylinder is limited, so as not to skid any of the wheels, in order to avoid wearing flat places on the tyres, and to produce the greatest effect in retarding the speed; a break power of from 14 to 22 tons can thus be obtained by the steam break alone. The break power obtained by the use of the throttle-valve alone, retarding the driving-wheels of the engine, is equal to that of the tender break, the regulator being open to the driving cylinders all the time. The application of the steam break by the engineman, may be followed immediately by that of the tender break by the fireman, and the guard's break in the van next to the tender; thus giving at once a greater break power than has usually been applied in retarding trains, and diminishing the liability to accidents from want of sufficient break power.

For the ordinary stoppages, the throttle-valve can be used to bring the train nearly to a stand, the tender break being applied for the last few yards only; this will effect a great saving in the permanent way, tender tyres, and break blocks. By partially closing the throttle-valve, trains may be controlled to any desired speed in passing down an incline, while a great surplus of break power is reserved in the steam-break cylinder, and the tender and van breaks, to bring the train to a stand quickly on the incline. In an experiment made with a gross load of 200 to 210 tons, down an average incline of 1 in 80, of 5 miles length, the train was controlled by the throttle-valve alone, from a speed of 30 miles per hour at starting, to 15 miles per hour down the whole incline. In approaching stations, half the time may be saved by the joint use of the tender break and the throttle-valve alone in the exhaust pipe, and a still further saving of time effected by also admitting the steam to the break cylinder. By using the steam break for ordinary purposes, in place of the tender break, there is less risk of heating and flattening the tyres, since the steam break is arranged so as not to skid the wheels.

In this method of obtaining break power from the engine, the speedy reversing of the engine valve gear from forward to backward gear is rendered an easy operation, whereby a further increase of retarding power is obtained; for the exhaust steam at the back of the driving pistons being compressed in the exhaust port by the closing of the throttle-valve, the pressure of steam inside the slide-valves becomes equal to or greater than that outside in the steam chest, so that a balance of pressure is established, enabling the valves to be reversed instantly with perfect ease. The partial closing of the throttle-valve may be employed to prevent violent slipping of the driving wheels, which will

revolve only in proportion to the quantity of steam allowed to escape from the exhaust-pipe, and this may be regulated to any extent by the throttle-valve, which can be worked with greater ease and nicety than the regulator.

The retarding power of this steam break was tested by the writer on the Scottish Central Railway, the results of which are given in tables appended to the paper. In the first two trials, only the throttle-valve in the exhaust-pipe was used, without the addition of the steam break cylinder, thus retarding only the driving wheels of the engine by the back pressure of the exhaust; the third trial was made with an engine having the steam break cylinder in addition to the throttle-valve.

From these experiments, it appeared that the retarding power produced by closing the throttle-valve in the exhaust-pipe was fully equal to that of the tender break, and the engine steam break also produced an effect fully equal to the tender break; so that, by employing both throttle-valve and steam break in conjunction with the tender break, the retarding power obtained was more than double that of the ordinary tender break alone.

Mr. R. Morrison remarked, that he had seen some experiments upon a steep incline of 1 in 40 on the Edinburgh and Glasgow Railway, with a steam break contrived by Mr. Paton which gave a very powerful retarding force; the break was applied to the leading and trailing wheels of a large tank engine having all the wheels coupled, and the pressure was produced by a steam cylinder communicating direct with the boiler. The action of the break was very efficient, but he believed the principal objection to it was found to be the great shock caused by its sudden application, which often deranged the levers of the apparatus, and occasioned an objectionable concussion to the train.

Mr. Allan said that, with the plan of the throttle-valve in the exhaust-pipe, this objection was removed, as the pressure came on gradually by the gradual compression of the exhaust steam; and no objectionable shock was perceived beyond what was of course unavoidable in stopping a quick-moving train within a short distance: a train at a speed of 40 miles per hour was stopped in 150 yards upon a level, by means of the steam break and tender break, without any objectionable shock being produced.

The following paper was next read:—"*Description of a steam crane,*" by Mr. J. Campbell Evans, of Greenwich.

The steam crane described in the present paper was designed more especially for use on board steam vessels; and the chief points to be aimed at were consequently compactness, facility of fixing, simplicity in the mode of working, and durability. In cranes usually constructed, the boiler being separate from the engine, the union joints of the steam pipe are very liable to leak; and the writer believes there are very few such cranes where this circumstance has not been a continual source of trouble and annoyance after a few months' regular work. Frequently the boiler is a considerable distance away from the cylinder, and then the steam and feed pipes are liable to be injured in stowing the cargo; in addition to which, the condensed steam strains the machinery, and keeps the deck of the vessel constantly wet and dirty.

To obviate these disadvantages, in the present steam crane, the boiler is placed as close as possible to the crane, and revolves with it; and by

making the top of the boiler of cast iron, with lugs for attaching the tension rods, it serves the double purpose of boiler and crane post. The bed-plate upon which the crane and boiler are placed is fixed to the foundation plate by a centre bolt, which bears all the upward strain; the downward pressure is taken by rollers, having their bearings in the bed-plate, and running on the foundation plate, which is solidly bedded on timber laid on the deck of the vessel.

To avoid upright tubes and horizontal tube plates, the heating surface of the boiler is arranged in cones; the first cone or fire-box is exposed to the direct radiation of the fire, after which the heat passes through an opening nearly opposite the fire-door into an annular space between the second and third cones, where it is absorbed by the water spaces on either side, and passes round to the funnel opposite. In this was a sufficient heating surface is obtained without any horizontal surfaces in the boiler for deposit to accumulate upon. The two angles or bottoms of the water spaces are below the direct action of the fire, and are connected by pipes to allow for the circulation of the water, provided with plugs and cocks for cleaning. The water tank is placed under the boiler; this position serving to heat the feed water and to preserve the cast-iron bed-plate from danger of fracture by the heat of the fire.

The crane is worked by a single oscillating cylinder, supported by brackets on the bed-plate. The joints for the steam and exhaust-pipes at the trunnions are made tight by gun-metal cones, fitted to the trunnions and held by studs in the brackets; when these have become polished by working, the wear upon them is very slight, and this construction has been found very suitable for the rough treatment to which cranes are usually subject. On the crank shaft is a friction wheel, grooved according to Mr. Robertson's plan, and kept continually revolving by the engine. On the second shaft is another friction wheel, which, by means of a lever, can be moved into gear with the driving wheel, or, by an opposite motion of the lever, can be pressed against a break, or when lowering can be held between the two. The other end of the second shaft carries pinions gearing into wheels on the shaft of the chain barrel. There are two pair of wheels and pinions, for varying the speed according to the weight to be raised; the pinions are thrown in and out of gear by a sliding key, instead of the ordinary clutch; by which means, the width between the frames that would be required for moving the ordinary clutch is saved.

The writer believes the principal difficulty experienced in steam cranes for ship purposes is in the arrangement of the turning gear; so that when the vessel leans over to one side, the crane shall be powerful enough to swing the weight, and yet not cause a sudden start or shock to break the gear. In this crane, a coned friction clutch is used, to allow a slip at first and to start the weight gradually; and the arrangement of the foundation plate of the crane admits of a much larger spur-wheel than usual being employed to bring up the power. On the crank shaft is a worm working into a worm wheel, on the shaft of which is a bevil wheel, gearing into the two bevil wheels above and below, which are thus kept constantly revolving by the engine. By means of a coned clutch acting on one or other of these wheels, the crane can be moved round either way, as desired. The two operations of lifting and turning the weight are easily managed by one man.

The valve motion of the oscillating cylinder is designed to compensate

for the oscillation of the cylinder without the use of sweeps and guides. A radius rod is centred on the cylinder bracket, and connected to the eccentric rod by a link, to which the valve rod is attached by a pin. The link combines the vibrations of the excentric rod and radius rod, so that at the point where the valve rod is attached, the curve described by the radius rod compensates for that described by the excentric rod in such a degree as to bring the valve rod into the curve it would naturally be made to describe by the oscillation of the cylinder.

Mr. Evans observed, that the crane was intended as a machine of simple construction, complete in itself, including boiler, for fixing in such situations as on decks of vessels or on quays, where generally the expense of larger stationary boilers for working a number of separate steam cranes could not be gone to. These cranes had worked very satisfactorily, the only wear after more than a year's work being in the bearing of the crank shaft, and by tightening up the nuts of the cap one-eighth of a turn, all the wear of some months was taken up. There was an advantage in the leverage in turning round, and the crane was found very convenient for handling; the grooved friction wheels, for connecting and disconnecting the motions, had proved very satisfactory, and worked smoothly and efficiently.

Mr. H. Maudslay enquired what pressure of steam was used, and what weight could be easily lifted by the crane; and what was the cost of the whole.

Mr. Evans replied, that 30 to 40 lbs. steam was used, and the crane lifted 50 cwts.: a larger size was being constructed to lift 50 cwts. 42 feet high in half a minute. The cost of the cranes at present made was about £200 complete; no pipes were required for connection to the boiler as in detached steam cranes, and no fixings were wanted for the crane or boiler; all that was required was to lay down 4 inch timbers to bed the frame upon, and it was a particular advantage in the case of ships that no holes were required in the deck for the crane post, the whole being self-contained.

Mr. E. A. Cowper thought it was a disadvantage in the arrangement that the steam must be shut off directly the load was off, to prevent the engine running away; and a single cylinder had this disadvantage—that it might stop on the centre, causing a delay in starting the crane again. He thought it was preferable, for working a crane, to have two cylinders working cranks at right angles and with link motion, as in Taylor's steam winch; the engines were then started or reversed readily, in whatever position they might have been stopped, and there was a decided advantage in thus getting rid of the fly-wheel.

Mr. Evans replied, this difficulty of a single cylinder was completely met in the present crane by having a small hole remaining open when the steam was shut off, which allowed steam still to pass just sufficient to keep the engine constantly moving at a slow speed, and turning only the first of the friction wheels. A double-cylinder crane would involve greater cost and complication, and a good deal of knocking was liable to occur in the gearing of a quick working crane on that plan; there was also the objection of water accumulating in the cylinders when standing, which was avoided by having the engine always moving.

Mr. H. Maudslay thought it a good idea to put the boiler at the back

end to balance the jib, which made an advantageous arrangement. In a 30 ton steam crane recently erected in the wharf at Messrs. Maudslay, Son, and Field's works, the engine was fixed upon the jib, consisting of a pair of small cylinders, with short stroke, working cranks at right angles; the crane lifted 30 tons, and the lowering and raising were done very smoothly by the cylinders; for lowering such a weight double cylinders were of course wanted, to prevent a jerk.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

July 7th, 1860.

MR. J. NEWTON, PRESIDENT, IN THE CHAIR.

The paper read was by Mr. JAMES ROBERTSON, iron merchant, of Bankside, on the "*Development of the Iron Trade.*"

BY desire of the Chairman, the author said he would now continue the consideration of the important subject he had endeavoured to illustrate, in an introductory paper, in March last. It would, however, be necessary for him to travel, in the first instance, over some of the ground he had then ventured upon; and he would take, as a starting point, the year 1740. It was in that year that the iron trade of this country had fallen into a state of great depression. But, as if to realize the truth of a very ancient adage, namely, that "when things are at their worst, they must mend," it was also at the same period when marked symptoms of improvement manifested themselves. The mode of manufacturing the metal began to be better understood, and the growing wants of society gave a corresponding impetus to its production. Agriculture came to its aid, and the cumbrous wooden ploughs, which for many centuries had been used for tilling the soil, gradually disappeared. Wheelless waggons, or sledges, more properly, fell into disuse. Iron tyres for wheels were adopted, and other changes, of a similar nature, were in course of introduction. Unhappily, however, whilst these advancements in the peaceful arts were progressing, those of a warlike nature were not stationary. Cannon, for the navy and army, were augmented in number and calibre; the demand for smaller weapons, for both services, keeping pace with the increase.

The war of the Austrian succession was being waged with fearful vigour. Russia was fighting with Turkey. The American colonies were clamouring for independence, for at that time America wore the yoke of England. The political atmosphere was clouded, and our statesmen saw fit to prepare for the portending storm. The last struggles of the Jacobites were being made. Charles Stewart had landed in Scotland, and in 1746 the battle of Culloden, which extinguished his hopes, was fought. These, therefore, were stirring times, and it is now well known what an impulse "wars, and rumours of wars," gives to the iron trade. The note of preparation is ever heard; the anvil and the hammer "discourse most eloquent music;" the artizan is in great request; contracts of a tempting and urgent kind are given out; and on all sides activity and bustle are visible.

In spite of all these sights and sounds, commerce was not stagnant; indeed it thrived rapidly, and about the year 1770, cotton became one of its leading features. Perhaps the precise day from which the greatness of the cotton manufactures of this country may date, was the 15th of July, 1769, for it was then that Richard Arkwright took out his patent for improvements therein. The story of Arkwright was well known. His machinery was soon in use in a thousand mills. Looms were working day and night, but the prejudice of the workmen of the day against them was very great. The hand-loom weaver regarded them with dismay. He could not see through the clouds of present adversity the day star of coming prosperity, nor compass the great fact, now so well understood, that manual labor alone is not able to deal adequately with the natural products of this richly productive land. It was equally impossible for him to comprehend, that if the cost of manufactures were reduced, the demand for the articles manufactured would inevitably increase in more than proportion to their cheapness. Riots accordingly took place, and machinery was burnt and destroyed. All these circumstances, nevertheless, contributed to the expansion of the iron trade. . . .

Then came the civil engineers, with their designs for iron bridges; the first cast-iron one being erected near Coalbrookdale, in Shropshire, in 1777. The second of these structures was designed by the notorious Thomas Paine, and erected at Bishopwearmouth, Sunderland. These, and other public works, requiring the liberal employment of iron, gave an increased impetus to the trade; whilst the formation of canals facilitated the transmission of the metal to the most distant parts of the empire. Our colonies, again, advancing in friendly rivalry with the mother country, became the recipients of vast quantities of iron. Mr. Robertson here introduced, incidentally, an admirable description of an emigrant's leave-taking and departure for the land of his adoption, which space, unfortunately, compels us to omit; and then spoke of the increase of the royal navy, consequent upon the extension of the British dominions, and the yet further demand for anchors and cables of iron, which this increase generated. The steam-engine, however, said the author, was the chief agent in the development of the iron trade. This modern Hercules, born of the ingenious brain, and reared by the skilful hand of the mechanic, obeys his will, and labors on for his advantage without complaint. Tracing next, the history of the steam-engine, from the time of the Marquis of Worcester to that of James Watt, the reader of the paper passed a glowing eulogium upon the man of Greenock, and drew from his life and character some lessons of a practical character. "Oh, what sources of knowledge," said he, "lie within ourselves, if we would but turn the bull's-eye light of calm observation upon the dark corners and recesses of our own souls! What hidden and lost treatures, of the existence of which we were ignorant, should we not find if we but zealously made search for them! What we read and study is but of little value, if there be not pegs in the wardrobes of our souls to hang the gathered knowledge on."

In conclusion, Mr. Robertson spoke of the impossibility of dealing with so vast a subject as he had chosen for illustration, in the brief compass of a paper like the present. The marine engine he must leave untouched, though the influence of steam navigation on the development of the iron trade was enormous. Railways, too, must be passed

over, for the present at least; whilst the iron and steel manufactures of Birmingham, Sheffield, Manchester, and Glasgow, would be barely mentioned. Ere the year had passed away, he hoped to pursue the subject yet further, although to do it justice was impossible. The paper concluded with a peroration on the engineer and his mission.

Scientific Adjudication.

WHEELER ET AL. *v.* TURNER.

May 31*st*, 1860.

THIS was a reference, with the consent of all parties, from the Court of Queen's Bench, to the decision of two arbitrators and an umpire or referee, to try an alleged infringement by the defendant of certain letters patent that had been assigned to the plaintiff.

The arbitrators appointed under the agreement, for reference, were Mr. William Carpmael and Mr. William Edward Newton, with Mr. Spence as umpire. Mr. Hindmarch appeared for the plaintiff, and Mr. Macgregor for the defendant. Messrs. Stone, Paget, and Billson, of Leicester, were the solicitors for the plaintiffs, and Messrs. Bower, Son, and Cotton, for the defendant.

From the documentary evidence produced, and the statements of the learned counsel, it appeared that Mr. Turner was, in the first instance, accused of infringing three several patents, of which the plaintiffs were assignees. One of these patents was, however, struck out of the list by the plaintiffs, before the agreement for reference was entered into, leaving two patents to be submitted to the consideration of the arbitrators.

The first of these patents was granted to Messrs. Nickels, Bull, and Bagley, and bears date 24th December, 1851, and the second patent was granted to Mr. Burrows, and bears date 27th March, 1858. The first patent included a variety of inventions or improvements, but the only portion alleged to have been infringed by the defendant was included under the third head, and thus described in the specification:—"Another improvement in such description of looms consists of so constructing and arranging the battens, that two rows of shuttles may be used in such manner that each fabric may have weft thrown in at the back and front of a middle warp, which may be composed more or less of india-rubber thread,—such middle warp not requiring any movement up and down; the silk or other warp threads rising and descending above and below the middle warp, to open sheds for the passage of the upper and lower shuttle for making each fabric. In this arrangement or construction of batten, only one reed is used for each pair of shuttles, and we cause the shuttles to move in opposite directions at the same time, as both top and bottom sheds are opened at the same time. The two rows of shuttles are similar to those employed in like descriptions of looms where only one shuttle is used to make a fabric; and the batten is made with two shuttle races or grooves, each similar to those employed in looms where only one row of shuttles is used."

The portion of the other patent alleged to have been infringed, was the mode of actuating the shuttles by peg motions, or rack and pinion motions. Mr. Hindmarch, however, in his opening statement, on behalf of the plaintiff, whithdrew this patent from the consideration of the court, and consented to be nonsuited on this part of the case. The question in dispute then became narrowed to the use of a standing india-rubber warp, in combination with the use of two shuttles, thrown simultaneously through two sheds. Evidence, on behalf of the plaintiff, was brought to show that this was a useful invention, and that it was new at the date of the plaintiffs' patent. On the part of the defendant, it was proved that, prior to the date of the plaintiffs' patent, he had worked several looms which threw shuttles simultaneously through two sheds, formed partly by a standing india-rubber warp; and this working he had continued for three years. Upon cross-examination, however it appeared, that the shuttles, for the greater portion of the time they had been thus used, were thrown simultaneously in the same direction; whereas the plaintiff contended, that his invention was for throwing them simultaneously in opposite directions.

The evidence for the defendant also showed, that the defendant had, for three weeks, worked a loom containing nine pairs of shuttles, by throwing them simultaneously in opposite directions, precisely in the way described by the plaintiff; but it appeared that, at the end of that period, the defendant had abandoned that plan of throwing the shuttles, and altered his loom so as to throw them in the same direction. On this ground it was contended, that the novelty of the plaintiff's alleged invention was destroyed; but it was, in reply, urged by the plaintiff, that his invention was not for throwing the shuttles in the same direction, but in opposite directions. The construction of the specification thus became the main element of dispute; the defendant contending, that the peculiar wording of this part of the description covered the combination of a standing india-rubber warp with the simultaneous passage of the shuttles through two separate sheds, in whatever direction the shuttles were thrown; while the plaintiff repudiated this construction of his specification, and maintained, that throwing the shuttles simultaneously in opposite directions, was a main element of the invention.

The questions left for the arbitrators to decide were, first, as to the construction of the plaintiffs' specification,—that is, whether it covered the throwing the shuttles simultaneously in the same, as well as opposite, directions, as urged by the defendant's counsel; or was confined to throwing the shuttles in opposite directions, as contended for the plaintiffs. Second, whether the working by the defendant, before the date of the plaintiffs' patent, of two shuttles thrown simultaneously in opposite directions, was such a public user of the invention as would destroy the novelty of the plaintiffs' invention.

The award of the arbitrators was to the effect, that the plaintiffs' invention was confined to the use of a standing india-rubber warp, in combination with two shuttles, thrown simultaneously in opposite directions. That the use, by the defendant, of this contrivance, before the date of the plaintiffs' patent, was not a public user of the invention, within the meaning of the statute, and that, therefore, the defendant had infringed this part of the plaintiffs' patented invention. The

second patent of the plaintiffs having been withdrawn, it was decided that, no infringement of this patent having being proved, the award as to the alleged infringement of this patent must be in favour of the defendant.

The effect of this award is to preclude the defendant from throwing his shuttles simultaneously in opposite directions, but it leaves it open to him, and all the world, to use the standing india-rubber warp, in combination with two shuttles thrown simultaneously in the same direction; this mode of operating the shuttles, having, during the progress of the case, been distinctly disclaimed by the plaintiffs as forming part of their invention.

PROVISIONAL PROTECTIONS GRANTED.

[*Cases in which a Full Specification has been deposited.*]

1503. John Smith, of Birmingham, for improvements in the manufacture of composition jewellery and ornaments, and in cases for jewellery, photographs, and for other similar purposes.—[*Dated June 1st.*]

1581. Claude Joseph Napoléon Rebour, of Paris, for a new motive power, so called "Rebour's motor."—[*Dated June 30th.*]

1592. Ephraim Chetwyn, of Worcester, for improvements in the manufacture of gloves.—[*Dated July 2nd.*]

1598. Charles Stevens, of Welbeck-street, for an improved navigable balloon or aerostatic ship,—being a communication.—[*Dated July 3rd.*]

1616. James Thomas Peter Newbon and Thomas Smith, both of Fenchurch-street, for improvements in apparatus or machinery and gearing for working, stopping, and holding chains in ships or vessels, and for moving or retaining heavy weights.—[*Dated July 4th.*]

[*Cases in which a Provisional Specification has been deposited.*]

766. John Dale, of Manchester, for improvements in the preparation of a coloring matter for dyeing textile materials and fabrics, and other substances.—[*Dated March 24th.*]

807. George Haseltine and John Adams Knight, both of Symond's-inn, Chancery-lane, for improvements in spring bed-bottoms,—being partly a communication.

814. John Dale, of Manchester, for improvements in obtaining albumen, or analogous substance, for use with pigments in calico printing, and for other purposes.

The above bear date March 29th.

824. John Davies and George Paine, both of Truro, Cornwall, for improvements in the manufacture of gunpowder,—[*Dated March 30th.*]

970. Germain Canouil, of Curtain-road, Shoreditch, for improved compositions for priming percussion caps, and a machine or apparatus employed therein.—[*Dated April 18th.*]

1016. Joseph Holder, of Scabes Castle, Brighton, for improvements in apparatus for consuming all noxious exhalations from drying ovens used for chemical and chemical manure works, and arising from such works, and from mixing decayed substances in strong acids.

1022. Edward Gatwood, of Holmer, near Hereford, for improvements in fixing and securing the rails in cast-iron or other chairs at joints and intermediate places in permanent ways.

The above bear date April 24th.

1090. Hiram Hutchinson, of Paris, for improvements in the manufacture of goods coated with india-rubber and other gums, and in apparatus to be employed therein,—being a communication.—[*Dated April 30th.*]

1162. George Holcroft, of Manchester,

for certain improvements in the manufacture of iron.—[*Dated May* 11.]

1180. Abraham Pullan, of New Cross, Thomas Creswell, of Lewisham, and Richard Longstaff, of New Cross, for improvements in steam generators, and in the means of, or apparatus for, superheating steam and in heating the feed-water.—[*Dated May* 12.]

1201. Domingos Sant Agata, of Lisbon, for an improved disinfectant.—[*Dated May* 16*th*.]

1214. Marc Antoine François Mennons, of Paris, for an improved carriage brake or drag,—being a communication.—[*Dated May* 17*th*.]

1242. James Copcutt, of Kirby-street, Hatton-garden, for improvements in manufacturing gas and carbon, or lampblack, in one or the same apparatus, and in the apparatus employed therein, and for means and apparatus for rendering the gas applicable for lighting of ships, lighthouses, mines, and all other places where gas can be used.

1244. Samuel Crompton and William Robertson, both of Manchester, for a new method of economising water passing through canals, when such water is used for dragging boats or otherwise.

The above bear date May 21*st*.

1296. Alfred Hubart and Victor Cantillon, of Liège, for improvements in the manufacturing of glass casks and barrels.—[*Dated May* 25*th*.]

1316. The Reverend Henry Moule, of Fordington, Dorsetshire, and James Bannehr, of Exeter, for improvements in the nature and construction of closets and commodes for the reception and removal of excrementitious and other offensive matter, and in the manufacture of manure from thence.—[*Dated May* 28*th*.]

1330. Thomas Gordon, of King-street, Soho, for improvements in inkstands.—[*Dated May* 30*th*.]

1346. Joseph Menday, of Frinsbury, Rochester, for improvements in kilns employed in and for the manufacture of cement.

1347. William Horatio Harfield, of Royal Exchange-buildings, for improvements in capstans and windlasses, and in shackling chains.

1348. Charles Clay, of Wakefield, Yorkshire, for improvements in implements for scarifying and grubbing or cutting up weeds, and otherwise cultivating land.

1349. Richard Threlfall, of Bolton, for improvements in the spinning machinery commonly called self-acting mules.

1350. Thomas Cresswell and Henry Lister, both of Huddersfield, for improvements in or applicable to fabrics composed of wool, cotton, silk, or other fibrous substances, or combinations of these or other fibrous substances.

1351. George Parsons, of Martock, Somersetshire, for improvements in the manufacture of carts, wagons, and drays.

1352. Thomas Greenwood and John Batley, both of Leeds, for improved machinery for cutting and shaping wood.

1353. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for a new and improved regutor for gas burners,—being a communication.

1354. Andrew George Hunter, the younger, of Newcastle-upon-Tyne, for improvements in the manufacture of chlorine.

The above bear date June 1*st*.

1356. William Stratford, of Mile-end, for improvements in fire bars.

1357. Charles William Lancaster, of New Bond-street, and James Brown and John Hughes, both of Newport, Monmouthshire, for improvements in cannon and other ordnance.

1358. James Austin, of Donaghadee, County Down, Ireland, for improvements in traction engines in connection with machinery or apparatus for ploughing or cultivating land.

1359. George Horner, of Belfast, for improvements in hackling flax and other fibrous materials, and in machinery for the same.

1360. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improved permutation lock,—being a communication.

1361. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery for kneading or preparing clay for the manufacture of bricks or other arti-

cles made from plastic materials,—being a communication.

1362. William Wilmer Henry Smith, of Birmingham, for improvements in the mode of, and apparatus for, preparing leather for harness and boot and shoe manufacturers.

The above bear date June 2nd.

1363. Isaac James, of Cheltenham, for improvements in washing, wringing, and mangling machines.

1365. John Juckes, of Newgate-street, for improvements in pipes for smoking tobacco.

1366. Jean Baptiste Pascal, of Paris, for improvements in obtaining motive power, and in apparatus for the same.

1367. William Edward Gedge, of Wellington-street, for improved machinery or apparatus for manuring land,—being a communication.

1368. Clovis Wateau, of Marle, Aisne, France, for an improved apparatus for cooling beer and other liquids.

1369. John Pinches, of Oxendon-street, Haymarket, for an improved press for embossing and stamping paper, linen, and other fabrics and substances.

1370. Thomas Reid, of Monkton Miln, Ayrshire, N.B., for improvements in machinery, apparatus, or means for actuating or working railway brakes.

The above bear date June 4th.

1371. William Taylor, of Nursling, near Southampton, for the improved heating of hot-houses and other buildings by means of flat pipes made of any malleable material, and for manufacturing thereof.

1373. Charles Senior, of Deadwaters, near Huddersfield, for apparatus for utilizing the waste heat in the flues of steam and other engines.

1374. George Fletcher, of Farnham-place, Southwark, for improvements in the apparatus for regulating the draft in the tubes of multitubular boilers,—being a communication.

1375. François Charles Richer, of the Waterloo-road, for improvements in breech-loading fire-arms and in their cartridges.

1376. William Trenter, of Clerkenwell-green, for improvements in washing and wringing machines.

1377. Joseph Jardin and Paul Adrien Girard, both of Paris, for a new or improved machinery for manufacturing brick, tiles, and other ceramic products.

1378. Antonio Joaquim Pereira de Carvalho, of Moorgate-street, for improvements in beams, applicable in the construction of bridges and other structures, and also for the floors and ceilings of houses.

1379. Edward Lavender and Robert Lavender, of Bromley-street, Stepney, for improvements in destructive and vinous distillation.

1380. George Bower, of St. Neots, for improvements in apparatus for manufacturing, controlling, and regulating the flow of gas.

1381. Joseph Apsey, of Cornwall-road, Lambeth, and William George Buckwell, of the Phœnix Stone Works, East Greenwich, for improvements in steam-boiler and other furnaces.

1382. George Hadfield, of Carlisle, for improvements in the manufacture of casks or barrels, and in the machinery to be used therein.

1383. George and Joseph Jenkins, of Young's-buildings, Aldersgate-street, for an improved portable arm chair.

The above bear date June 5th.

1384. Sigismund Schuhman and George Harrison, both of Burnley, Lancashire, for improvements in machinery or apparatus for spinning, doubling, and winding fibrous materials.

1385. Edward Thomas Hughes, of Chancery-lane, for improvements in coating or plating the faces of printing type and stereotype plates,—being a communication.

1386. Francis Herbert Wenham, of Brixton, for improvements in steam-engines.

1389. Marcel Gripon Deschamps, of the Strand, for improvements in machinery for carving and sculpturing.

1390. Joseph Jewsbury, of Kinver, Staffordshire, for certain improvements in machinery for the manufacture of screws.

1391. Charles Hadfield and William Alfred Attkins, both of Hadfield, Derbyshire, for improvements in machinery for preparing, making, and moulding bricks, tiles, and other

articles formed of clay, peat, or other materials.

1392. Peter Hooley and John Wood, both of Manchester, for an improvement in the manufacture of cotton wadding and in machinery or apparatus connected therewith.

1393. John Saunders and Joseph Piper, both of Kidderminster, for improvements in the manufacture of tin and terne plates.

The above bear date June 6th.

1395. James Brown, of Stratford, Essex, for improvements in fire-bars, retorts, and other appliances connected with furnaces, &c.

1396. Thomas William Miller, of Her Majesty's Dockyard, Portsmouth, for improvements in boilers or steam generators.

1397. Pierre Vangeneberg, of La Chapelle, St. Denis, Paris, for an improved locomobile steam-saw-mill.

1398. James Parker Bath, of Aigburth, near Liverpool, for improvements applicable to carriage wheels for use on common highways, railroads, or tramways.

1399. Jeffries Kingsley, of Great Coram-street, for improvements in testing screw-propellers and paddle-wheels.

1400. Edwin Henry Higginbotham and Aaron Beech, both of Macclesfield, for certain improvements in machinery or apparatus for the prevention of explosions of steam-boilers, arising through deficiency of water or over pressure of steam.

1401. Robert Bromwich, of Birmingham, for an improved cock for drawing off or regulating the flow of liquids or fluids.

1402. Edward Joseph Hughes, of Manchester, for certain improvements in machinery or apparatus for roving, spinning, and doubling cotton, wool, flax, and other fibrous materials,—being a communication.

1403. William Clark, of Chancery-lane, for improvements in electric telegraph apparatus,—being a communication.

1404. William Clark, of Chancery-lane, for improvements in the preservation of animal and vegetable matters,—being a communication.

1405. Eustache Michel-Sainton, of Paris, for improvements in knitting processes, and in apparatus for the same.

1406. Moritz Jacoby, of Nottingham, James Redgate, of Sneinton, Nottinghamshire, and Joseph Stones, of Nottingham, for improvements in the manufacture of bobbin-net or lace, in bobbin-net machines.

1407. George John Cookson, of Dorset-street, for improvements in gas regulators,—being a communication.

1408. George Arthur Waller, of Dublin, for improvements in apparatus for filtering and solidifying.

The above bear date June 7th.

1409. James Wright, of Bridge-street, Blackfriars, for an improved apparatus for washing and separating metals or their ores from impurities or other foreign matters which are mixed with them,—being a communication.

1411. George Tomlinson Bousfield, of Loughborough-park, Brixton, for improvements in machinery for the manufacture of barbed and other needles for knitting and sewing,—being a communication.

1412. Alexander Angus Croll, of Coleman-street, for improvements in the purification of gas.

1413. George Mackenzie, of Paisley, for improvements in machinery or apparatus for twisting and doubling yarns and thread.

1414. James Monks, of Alton, for improvements in the rails and chairs of railways.

1415. Philippe Grimaldi, of Teramo, Naples, for improvements in steam generators.

1416. George Joslin, Henry Crush Joslin and John Joslin, all of Colchester, for improvements in reaping machines.

1417. William Edward Newton, of the office for Patents, 66 Chancery-lane, for certain improvements in sewing machines,—being a communication.

1418. William Richardson, of Moreton place, Kentish Town-road, for an improved method of joining and fixing together drain, water, or gas pipes made of burnt clay or other earthy vegetable or mineral matter, thereby rendering them air and water tight and preventing leakage.

The above bear date June 8th.

1419. Charles Stevens, of Welbeck-street, for improvements in smoke-consuming furnaces,—being a communication.

1420. Joseph Westwood, of Bow, for improvements in armour plates for iron ships and vessels, or forts, or batteries.

1421. Richard Matley, of Manchester, for certain improvements in machinery or apparatus for printing woven fabrics.

1422. William Edward Gedge, of Wellington-street, for improved apparatus for separately collecting the divers metals of which minerals, ores, and their gangues are composed, —being a communication.

1423. Charles Breese, of Birmingham, for improvements in metal bedsteads.

1424. Robert Romaine, of Myddelton-square, for improvements in the construction of steam-boilers and condensers.

1425. James Combe, of Belfast, for improvements in roving and slubbing frames, and in the means of transmitting power thereto, and to machinery generally.

The above bear date June 9th.

1426. Frederick Crace Calvert, Charles Lowe, and Samuel Clift, all of Manchester, for improvements in the manufacture of coloring matters.

1427. William Johnson, and Isaiah Adamson, both of Liverpool, for improvements in hydraulic or other like presses, and in the apparatus connected therewith, for extracting oils from seeds.

1429. John Henry Johnson, of Lincoln's-inn-fields, for improvements in governors or regulators for steam-engines,—being a communication.

1430. Peter Salmon, of Glasgow, for improvements in furnaces and in feeding steam-boilers.

1431. Alexander Theophilus Blakely, of Holywood, county Down, for an improvement in rolls or rolling mills.

1432. Hubert Sommelet, of Paris, for certain improvements in the manufacture of scissors.

The above bear date June 11th.

1433. Theophilus Redwood, of Montague-street, Russell-square, for improvements in the manufacture of paper.

1434. Jabez Bunting Farrar and Joshua Farrar, both of Halifax, Yorkshire, for improvements in machinery or apparatus for spinning and doubling, or twisting wool, mohair, alpaca, cotton, silk, flax, or other fibrous substances.

1435. John Clarke, of Heaton Norris, Lancashire, for an improved registering apparatus applicable to gauges for steam, water, vacuum, heat and similar purposes, and also an improved mode of weighting or balancing the ordinary index finger of gauges.

1436. Thomas Chadwick Yates, of Manchester, for the manufacture of adjustable spikes for attaching to shoes or other coverings for the feet.

1437. Thomas Willis and George Chell, both of Longsight, near Manchester, for improvements in machinery for twisting, doubling, and winding yarn and thread.

1438. Robert Hyde, of Kirkby, Leicestershire, for improvements in apparatus for draining stables.

1439. Phillippe Fromont, of Chatelinau, Belgium, for improvements in machinery for the ascending and descending in pits or mines, of workmen, waggons, carriages, and materials.

1440. Caspar Loewenstein, of Crutched-friars, for improvements in arrangements for paying out submarine cables.

1441. George Burrows, of Nottingham, for improvements in the manufacture of figured lace made on bobbin net machines.

1442. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved carriage ventilator,—being a communication.

1443. George Catlin, of New York, for improvements in the construction of ships and other floating bodies.

1444. George Firmin and Cornelius Firmin, both of Ipswich, for improvements in the manufacture of sacking, and in apparatus for the same.

1445. Jacques Hippolyte Thierry, of Paris, for improvements in the manufacture and composition of ink for printing.

The above bear date June 12th.

1446. Louis Pellissier, of Bordeaux, for an improved apparatus for lifting and

moving blocks of stone or other heavy materials or loads.

1447. John Lancaster, of Dunmurry, Belfast, for improvements in whetstones, commonly called scythe stones.

1448. William Spence, of Chancery-lane, for improvements in the mode of and apparatus for reducing silicious substances to a fluid state,—being a communication.

1449. William Weston, of Camden Town, and Benjamin Price, of Mile End, for improvements in ovens for baking.

1450. George Henry Chatwin, of Gresham-street, for an improvement in the ribs of parasols and other like articles.

1451. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved construction of weighing machine,—being a communication.

1452. John James Bowen, of Great Dover-street, Southwark, for improvements in soldering irons heated by gas.

The above bear date June 13th.

1453. Gaetano Delauretis, of Naples, for an improvement in preventing and detecting forgery or alteration of figures in cheques, bank-notes, drafts, bills of exchange, promissory notes, and other monetary bills.

1454. Michael Henry, of Fleet-street, for improvements in treating vegetable substances so as to obtain paper-pulp, and other useful products therefrom,—being a communication.

1455. Isaac Whitesmith and James Steven, both of Glasgow, for improvements in looms for weaving.

1456. Edward Sparkhall, of Cheapside, for improvements in producing certain designs and patterns upon cloth or textile fabrics, in order to procure certain effects in garments made therefrom.

The above bear date June 14th.

1457. John Dooley and James Mawson, both of Dukinfield, for an improved equilibrium slide-valve, applicable to engines worked by steam or other motive power.

1459. George Davies, of Serle-street, for an improved life-preserving mattress,—being a communication.

1460. Isaac Mackrow, of Poplar, for improvements in alarum locks and latches.

1461. James West, of Birmingham, for an improvement in the bowls or rollers of castors for furniture.

1462. Cowper Phipps Coles, of the United Service Club, for improvements in iron-cased ships of war.

1463. Richard Archibald Brooman, of Fleet-street, for improvements in desiccating substances, and in neutralizing or retaining any fœtid gases which may be evolved in the process,—being a communication.

1464. William Harding, of Rutland-terrace, Forest-hill, for improvements in breech-loading firearms.

The above bear date June 15th.

1465. Charles Coates, of Sunnyside, near Rawtenstall, Lancashire, for improvements in the construction of breaks for carriages.

1466. Myer Myers, Maurice Myers, and William Hill, all of Birmingham, for certain improvements in holders and connectors for holding papers and fancy wares, exposed for sale or for private use.

1467. John Moule, of Seabright-place, Hackney-road, for an improved self-acting apparatus for precipitating and collecting from solutions metals and their salts; part of which apparatus is applicable to flushing purposes.

1468. William Dray and Robert Gardiner, both of Farningham, Kent, for improvements in reaping and mowing machines.

1469. Benjamin Pavyer, of Bartholomew-close, for certain new or improved machinery for "rubbing" type,—being a communication.

1470. Edward Deane, of Arthur-street East, London Bridge, and Willoughby Digby Marsh, of James-street, for improvements in kitchen ranges or apparatus for cooking.

1471. John Hickman, of Brampton Ash, Northamptonshire, for improvements in draw-bars for railway carriages and trucks.

1472. Charles Henderson, of Leicester, for improvements in flooring and bench cramps.

1473. William Clark, of Chancery-lane, for improvements in storing and preserving grain, and in the appara-

tus connected therewith,—being a communication.

1474. Henry Widnell, of Lasswade, Edinburgh, for improvements in printing and steaming threads and yarns of worsted and other materials for carpets and other fabrics, and in the apparatus employed therein.

1475. Edward Stone, of Lime-street, for improvements in machinery for cutting veneers,—being a communication.

The above bear date June 16th.

1476. Thomas Kershaw, of Baker-street, Portman-square, for improvements in apparatus for imitating various fancy woods, marbles, granites, and stencillings.

1477. John King, of Wellesbourne, and Frederick Southam, of Eatington, Warwickshire, for a new or improved rope porter, to be used in steam ploughing or cultivating.

1478. Hamlet Nicholson, of Rochdale, for a new and improved cricket and playing ball.

1479. Robert Dressel, of De Beauvoir-grove, Kingsland-road, and Augustus Figge, of High Holborn, for improvements in the manufacture of yeast.

1480. Thomas William Keates, of Chatham-place, Blackfriars, for an improved mode of separating carbonic acid gas from the gaseous products derived from the distillation of peat and other vegetable matter.

The above bear date June 18th.

1481. James Braby the younger, of Bridgehouse-place, Southwark, for improved machinery for lifting or breaking up roads or ways, crushing clods, and scarifying or tilling land.

1482. Augustus Bryant Childs, of New Oxford-street, for improvements in the manufacture of a portable pocket match safe,—being a communication.

1483. Alexander Robertson Arrott, of Saint Helen's, Lancashire, for improvements in the manufacture of carbonate of soda.

1484. Michael Baragwanath, of Truro, for an improved portable hydraulic punch,—being a communication.

1485. Joseph Harrison, of Glossop, for certain improvements in machines for spinning cotton and other fibrous substances.

1486. John Walker, of the City-road, for improvements in mills or machinery for expressing juice from the cane and other like vegetable substances.

1487. Richard Archibald Brooman, of Fleet-street, for improvements in locks,—being a communication.

1488. Joseph James Welch, of Cheapside, for improvements in neck-ties, scarfs, and cravats.

The above bear date June 19th.

1489. William Kendall and George Gent, both of Salford, near Manchester, for improvements in machinery or apparatus for making gas burners.

1491. William Willcocks Sleigh, of Myddleton-square, for the neutralific motive-power engine.

1492. George Hinton, of Birmingham, for improvements in cupola furnaces.

1493. Alfred Arthur, of Southampton, for obtaining and applying motive-power.

1494. Henry Wimball, of Aldermaston, Berkshire, for improvements in machinery or apparatus for making bricks, tiles, and drain-pipes.

1495. Henry Hart, of Greenwich, for improvements in machinery or apparatus for cutting and shaping metals and other substances.

1496. Edward Brainerd Webb, of George-street, Westminster, for improvements in breakwaters and piers.

1497. Henry Franklin Hiron, of Chipping Campden, Gloucestershire, and Richard Fell, of Albion-place, Walworth, for an improved vertical paddle-wheel.

1498. Francis Constable Simons, late Captain Bengal Artillery, for improvements in ordnance.

1499. Rudolph Bodmer, of Thavies-inn, for improvements in machinery for washing textile fabrics,—being a communication.

1500. Francis Preston, of Manchester, for certain improvements in machinery for shaping and cutting files and rasps.

1501. Adolphe Corroyer, of Blooms-grove, Radford, Nottinghamshire, and Moses Barton, of Nottingham, for a new or improved washing machine, with the machinery or apparatus employed therein.

The above bear date June 20th.

1502. John Telfer, of Newcastle-upon-Tyne, for improvements in capstans and winches for hoisting; which improvements are also applicable to the steering of ships.
1504. William Augustus Munn, of Throwley House, near Faversham, for an improved cartridge pouch.
1505. Dennis Lee and Anthony Welsh, of Leeds, for improvements in means or machinery for preparing and polishing marble.
1506. Thomas Walker, of Birmingham, for improvements in means or apparatus for indicating the height of water in steam-boilers.
1507. William Baker, of Sheffield, for improvements in the process of softening and purifying lead.
1508. William Pitt Eastman, of Newark, New Jersey, U.S.A., for improvements in bolts for fastening doors, gates, and windows,—being a communication.
1509. William Reade, of Hibernia-chambers, Southwark, for improvements in apparatus for singeing and preparing the skins of pigs previous to curing.
1510. William Clark, of Chancery-lane, for improvements in machinery or apparatus for the manufacture of envelopes,—being a communication.
1511. Henry Buenaventura Stevenson, of Alfred-street, Bedford-square, for improvements in apparatus for propelling, and in other rotary apparatuses.
1512. Arthur Turner Clark and John Price, of Southampton, for improvements in signal lanterns.
1513. William Buckwell, of Phœnix Stone Works, East Greenwich, for improvements in moulding blocks, slabs, pipes, and other articles, and in the apparatus to be employed therein.

The above bear date June 21st.

1514. Aignan Jutteau, of Orleans, France, for a new system of plating and plastering houses and public buildings with natural stones.
1515. William Morris, of the Minories, and Henry Mapple, of Child's Hill, Hampstead, for improvements in apparatus for electric clocks and telegraphs.
1517. William Howells, of Carmarthen, for a portable window platform.
1518. George Simpson, of Sheffield, for improvements in wine decanters and waggon or travelling decanter stand.
1519. William Edward Gedge, of Wellington-street, for improvements in saddlery and harness,—being a communication.
1520. William Edward Gedge, of Wellington-street, for improvements in blinds, called venetian or jalousies,—being a communication.
1521. Walter Macfarlane, of Glasgow, for improvements in water closets, and sewerage and sanatory apparatus or appliances.
1522. John Wilson, of Glasgow, for improvements in the manufacture or production of sulphur or brimstone, sulphurous acid, and sulphuric acid.
1523. Nicholas Grattan, of Cork, for improvements in gilding steel and other metals.
1524. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in lithographic printing presses,—being a communication.
1525. John Dewick, of New Lenton, Nottinghamshire, for improvements in bobbin-net or twist-lace machinery.
1526. Richard Archibald Brooman, of Fleet-street, for improvements in horse-rakes,—being a communication.

The above bear date June 22nd.

1527. John Ramsbottom, of Crewe, Cheshire, for improvements in supplying the tenders or tanks of locomotive engines with water.
1528. David Dawson, of Milnes Bridge, near Huddersfield, for improvements in the dyeing of cotton, wool, or waste, black and brown.
1529. James Joyce, of Birmingham, and Abraham Morley, of Hinckley, for a new machine, or improved mechanical arrangements, or combinations, for the manufacture of stockings, vests, and other articles of hosiery.
1530. James Ward, of Queen's-street, Pimlico, for improvements in water-closets.
1531. Robert Jobson, of Dudley, Worcestershire, for improvements in

moulding articles of earthenware or porcelain.

1532. Henry Jones, of Annery, near Bideford, for improvements in water-closets.

1533. Robert Andrew Boyd, of Southwark, for improvements in singeing or burning the hair off pigs.

1534. Joseph Lane, of Old Ford, for improvements in apparatus for grinding edge and other cutting tools.

1535. David Crosman Dinsmore, of Boston, U.S.A., for an improved churn,—being a communication.

1536. Pierre Pailleron, of Chandon, Loire, France, for an improved apparatus for distilling.

1537. Edward Gatwood, of Holmer, near Hereford, for improvements in making wheels, applicable to railway carriages and locomotive engines.

The above bear date June 23rd.

1538. Abraham Barnsley, of Rowley Regis, Staffordshire, for improvements in apparatus for the manufacture of welded iron tubes.

1539. David Crosman Dinsmore, of Boston, U.S.A., for improvements in machinery for splitting leather and cutting the heels of boots and shoes.

1540. John Henry Johnson, of Lincoln's-inn-fields, for improvements in hydraulic apparatus for obtaining motive power, and for raising water, —being a communication.

1541. Henry Creaser, of York, for improvements in reaping and mowing machines.

1542. George Davies, of Serle-street, for improvements in the needles used in machinery for manufacturing ribbed stocking fabric,—being a communication.

1543. William Routledge, of Salford, near Manchester, for improvements in self-acting feed apparatus for steam-boilers.

1544. William Higginbottom, of Whittington, Derbyshire, for improvements in pipe joints and valves for gas or water mains, and sanatory purposes generally.

1545. Edwin Thomas Truman, of Old Burlington-street, for improvements in horse shoes.

1546. William Hooper, of Mitcham, for improvements in re-working compounds of india-rubber and sulphur, and in insulating telegraphic wires or conductors.

1547. William Reade, of Hibernia Chambers, Southwark, for improvements in apparatus for carbonizing or partially charring the skins of pigs previous to curing.

The above bear date June 25th.

1548. George Jordan Firmin, of Borough-road, Southwark, for improvements in furnaces and fireplaces.

1549. Matthew Cartwright, of Carlisle, for improvements in the manufacture of mouth-pieces, for dental and other purposes.

1550. William Henry Hudson, of Hereford, and John Evans, of Lugwardine, Herefordshire, for improvements in locks.

1551. John Shaw and Joseph Tunnicliff Pope, of Burslem, Staffordshire, for improvements in the articles technically known as "flys," or "flyers," used in the process of spinning and preparing woollen, worsted, cotton, and other fibrous materials.

1552. Jabez Elul Barnsley, of Rowley Regis, Staffordshire, for improvements in the manufacture of welded iron tubes, and in machinery employed in the said manufacture.

1553. Henry Cartwright, of the Dean Broseley, Salop, for improvements in means or apparatus in connection with steam-engines, to facilitate the working of the same expansively.

1555. George Tosco Peppé, of Sydenham, for improvements in apparatus for keeping time, for weighing letters and other matters, and for levelling.

1556. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery for the manufacture of lace or bobbin-net,—being a communication.

The above bear date June 26th.

1557. William Macnab, of Greenock, for improvements in, and connected with, marine and other steam-engines.

1558. Robert Formby, of Liverpool, for improved apparatus for applying water-power to the working of ships' pumps and winches, and to other useful purposes.

1560. John Macintosh, of North-bank,

Regent's-park, for improved compounds for coating or insulating submarine or other telegraphic wires; also in rendering the gutta-percha or india-rubber coatings of telegraphic wires impervious.

1561. John Campbell Evans, of the Morden Iron Works, East Greenwich, for improvements in machinery or apparatus for rolling or drawing metals and other substances; partly applicable to the covering of electric telegraph cables, and to the manufacture of wire and other ropes.

The above bear date June 27th.

1562. William Henry Fletcher, of Denmark-court, Golden-lane, for improvements in the form and arrangement of stoves for heating irons used for dressing and polishing shirts, collars, and similar articles, and also in the figure or form of the said irons.

1563. Christopher Binks, of Parliament-street, Westminster, for improvements in manufacturing oxygen gas.

1565. William Pidding, of the Borough-road, Southwark, for improvements in fire-lighters, their form or shape, and the machinery or apparatus used in their manufacture.

1566. James Blakeley and William Henry Blakeley, both of Netherton, near Huddersfield, for improvements in machinery or apparatus for sawing or cutting wood, bone, ivory, stone, or other vegetable, animal, or mineral substances.

1567. Charles Bosselaers, of Mark-lane, for an improved apparatus for corking bottles, jars, and other vessels,—being a communication.

1568. Jacob Allen, of Travalgar Wharf, Ratcliffe Cross Stairs, and Josiah Glasson, of Fore-street, Limehouse, for an improved method of connecting together the several tubes used in connection with steam-boilers for superheating steam.

1569. William Campion and William Campion, both of Nottingham, for improvements in sewing machines.

1570. Westley Richards, of Birmingham, for improvements in ordnance; also in cartridges and cap-holders.

The above bear date June 28th.

1572. John Sale, of Chesterton, Staffordshire, for improvements in the construction of ovens and of chambers in ovens for firing bricks, tiles, pipes, quarries, and other articles of the like nature.

1573. John Whitehouse, of Birmingham, for an improvement in the manufacture of metallic door and other knobs, and a new or improved method of connecting door and other knobs with their spindles.

1574. Thomas Wilson, of Birmingham, for improvements in breech-loading firearms, and ordnance, and in cartridges.

1575. James Taylor, of Birkenhead, for improvements in locomotive engines and wheel carriages.

1576. James Soutter, of Hoxton, for improvements in steam-boilers, and an improved arrangement of steam-engine to be used therewith.

1577. François Vouillon, of Louviers, France, for improvements in drawing, twisting, and felting, filamentous, fibrous, or textile materials.

1578. William Hale, of John-street, Adelphi, for improvements in impelling shells or shots, and in apparatus for directing their flight from ships or vessels; which apparatus is applicable to guns or mortars used on board ship for preventing them being acted upon by the pitching or rolling of the ship or vessel.

1579. George Cheesman Morgan, of Newcastle, Pennsylvania, U.S.A., for improvements in looms,—being a communication.

1580. George Cheesman Morgan, of Newcastle, Pennsylvania, U. S. A., for improvements in the manufacture of driving belts and straps,—being a communication.

The above bear date June 29th.

1582. William Edward Gedge, of Wellington-street, for improved bricks and tiles,—being a communication.

1583. Andrew Hawksey, of St. Helen's, Lancashire, for an improved method of drawing and withdrawing window curtains and other similar hangings.

1584. Thomas Cox, the younger, and Robert Harrington, both of Birmingham, and William Holland, of King's Norton, Worcestershire, for improvements in the manufacture of runner notches and top notches for umbrellas and parasols.

1585. Henry Francis Cohade, of Gravelle, St. Maurice, France, for improvements in obtaining motive power.

The above bear date June 30th.

1587. James Newhouse, of Farnworth, near Bolton-le-Moors, for certain improvements in machinery for spinning and doubling cotton and other fibrous materials.

1588. Célestin Philippe Gontard, of Paris, for improvements in remontoirs for winding up and setting right watches without keys.

1589. Louis Frederic Moulin, of Brussels, for an improved system of water-gauge for steam-boilers.

1591. Edward Chambers Nicholson, of the Kennington-road, for improvements in the manufacture of a peroxide of lead, having peculiar oxidizing properties.

1593. Hobert Henry Bishop, of Bristol, U.S.A., for improvements in sewing machines.

1594. John Aitken Salmon, of Glasgow, for improvements in apparatus for feeding boilers, and in furnaces.

1596. Richard Archibald Brooman, of Fleet-street, for improvements in the manufacture of hats,—being a communication.

1595. William Edward Gedge, of Wellington-street, for improvements in chairs and other articles of furniture, to be used principally at sea,—being a communication.

1597. Richard Archibald Brooman, of Fleet-street, for improvements in harrows,—being a communication.

The above bear date July 2nd.

1599. Henry John Standly, of Pall Mall East, for improvements in retorts, crucibles, and other vessels, employed for the purposes of fusion and distillation.

1600. Charles Joseph Eugène Dumont, of Liège, for improvements in machinery or apparatus for separating minerals and substances of different specific gravities.

1601. James Haughton, of Gomersal, Yorkshire, for improvements in machinery or apparatus for slubbing and spinning wool or other fibrous substances.

1603. Robert Nicol Reid, of University-street, for improvements in insulators for electric telegraph purposes.

1604. Joseph Lane, of Old Ford, for improvements in screw-cutting lathes.

1605. Richard Archibald Brooman, of Fleet-street, for an improved fabric, suitable for holding charges of gunpowder,—being a communication.

1606. Lionel Edward Weber, of Brussels, for improvements in pipes and cigar-holders.

1607. John Butler Broadhurst, of Compstall, near Stockport, for improvements in heating water for steam-boilers.

1608. Thomas Richardson, of Newcastle-on-Tyne, for improvements in purifying coal gas.

1609. James Morris, of Albert-square, Clapham-road, for an improved key for securing railway rails.

1611. François Durand, of Paris, for an improved means of driving spindles used in spinning machinery; applicable also to the communicating of rotary motion for other purposes.

1612. François Durand, of Paris, for an improved mode of purifying the Thames and other tidal rivers.

The above bear date July 3rd.

1613. William Skinner, of Williamsburgh, Massachusetts, U.S.A., for a new and improved machine for stretching and glossing silk,—being a communication.

1614. George Stephen Harris, of Oxford-street, for improvements in apparatus for rapidly cooling or refrigerating water, wine, beer, or other liquids.

1615. Samuel Perkes, of Clapham, for improvements in presses and modes of pressing; applicable to cotton, hemp, wool, coir, hides, hay, fibres, peat, linen, thread, piece goods, extracting oil, and other useful purposes.

1617. Henry John Standly, of Pall Mall East, for improvements in the production of gases for illumination and other purposes.

1618. John Shipley, James Taylor, and Joseph Shuttlewood, all of Leicester, for improvements in knitting machinery.

1619. James Haywood, junior, and Thomas Claridge, both of Derby,

for an improved arrangement of combined thrashing and dressing machine.

1621. Alexander Doull, of Westminster, for improvements in excavating or clearing away earth, sand, and other substances, prior to forming foundations under water and otherwise.

1622. John Blake, of Sheffield, for improvements in the manufacture of guns and firearms of steel.

1623. Cadogan Williams, of Newcastle, Glamorganshire, for improvements in means or apparatus for the protection of the coast of a country from invasion by ships or other vessels.

The above bear date July 4th.

1625. William Stevens Squire, of Acacia-road, St. John's Wood, for improvements in the production of colors for dyeing and printing.

1627. John Ogden, of Manchester, for certain improvements in power-looms for weaving.

1628. Walter Hood, of Glasgow, for improvements in ladies' riding trousers.

1629. Henry John Stanley, of Pall-Mall East, for improvements in the production of gases for illumination and other purposes.

The above bear date July 5th.

NEW PATENTS SEALED.

1859.

2032. John Giles.
2360. Frederick Dressler.
2717. C. A. Fournier.
2896. Joseph Willcock.
2904. James Ferrabee.
2905. Henry Bayley.
2910. William Dempsey.
2913. William Abbott.
2914. J. Glasson.
2921. B. Fleet, J. Rawlings, and T. Cloake.
2923. F. A. Abel.
2925. W. E. Gedge.
2930. R. D. Guthrie.
2931. R. A. Brooman.
2936. D. Hulett and G. Boccius.
2938. R. G. Hill.
2943. F. G. Spilsbury.
2953. X. C. De Nabat and A. C. De Nabat.
2958. Alexander Mc Dougall.
2961. F. P. Janniard.
2962. C. S. Rostaing.
2967. Samuel King.
2972. Thomas Fearnley.
2973. T. R. Russell.
2975. T. S. Cressey.
2977. Joseph Cliff.
2979. Joseph Cliff.
2988. W. E. Gedge.
2990. Joseph Whitworth.
2996. Robert Gibson.
2997. Henry Munster.
2998. William Jackson.
3000. John Eason.

1860.

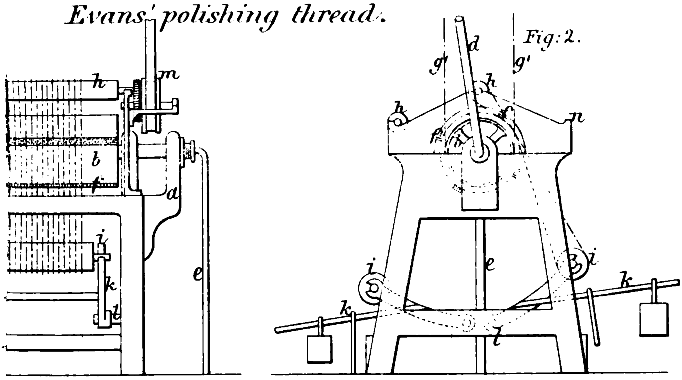
2. Jozé Luis.
4. H. A. Dewar.
6. Alexander Prince.
7. S. Rowbotham and T. Gratton.
10. John Horridge.
14. D. and S. Bateman.
15. Frederic Hudson.
21. George Davies.
24. M. A. F. Mennons.
25. Joseph Walls.
26. P. J. Worsley.
31. Austin Chambers.
34. John Fisher.
36. R. A. Robinson.
39. John Knowles.
41. R. C. Videgrain.
42. Thomas Moy.
43. John Fowler.
44. L. F. Perrier.
50. J. and C. Hawkins.
51. Benjamin Bayliss.
55. J. W. Wilson.
56. J. F. Hillel.
57. George Beningfield.
58. Pierre Czugajewicz.
60. J. A. Coffey.
61. W. H. Thornthwaite.
63. Samuel Isaac.
64. Maurice Vergnes.
67. W. T. B. Allday.
70. William Cotton.
71. Adolph Strauss.
72. John Jameson.
76. O'Donnell Grimshaw.
77. W. E. Newton.
80. A. West and J. Robinson.
82. Charles de Bergue.
83. Eugéne Ferrier.
89. Robert Burley.
92. E. Harrison and J. Scott.
95. Joseph Hayes.
96. Joseph Goddard.
97. John Musselwhite.

98. John Eunson.
100. M. A. F. Mennons.
106. T. J. Smith.
107. Willoughby Smith.
109. J. Chatterton and W. Smith.
111. A. M. Rendel.
112. Joseph Stenson.
116. Samuel Fearnley.
118. R. A. Brooman.
120. J. F. Spencer.
124. Job Goulson.
126. Henry Medlock.
127. G. J. Barker and T. Barker.
128. W. and P. Smith.
129. Alexander Chaplin.
131. G. Ermen and J. Platt.
133. J. B. Berger.
135. N. D. Maillard.
136. T. Curtis and J. Haigh.
137. Harrison Blair.
138. William Dawes.
139. Joseph Needham.
140. Anthony Bower.
144. John Timmins.
146. John Shaw.
147. G. H. Cottam and H. R. Cottam.
151. J. F. Meakin.
152. Henry Walker.
153. C. P. P. Laurens.
154. J. W. Scott.
156. W. E. Gedge.
157. W. E. Gedge.
158. Octave Vivier.
162. Alexander McDougall.
165. Martin Rae.
166. James Potter.
168. A. V. Newton.
169. R. F. Finlay.
171. E. L. Gatellier.
172. C. C. J. Guffroy.
174. C. H. Reed.
175. Charles Iliffe.
176. E. J. Hughes.
178. Timothy Harrington.
179. J. T. Carter.
185. Frederick Yates.
187. T. Ramspacher and C. F. Schmidt.
189. Thomas Dorkin.
193. H. J. Huggins.
194. G. Ryder and J. Clay, jun.
200. J. Ingham and G. Hinchliffe.
201. Peter Effertz.
203. J. J. Maurer.
206. C. F. Varley.
208. R. & P. Sykes.
209. Frederick Walton.
211. J. H. Johnson.
212. J. Duncan, A. Scott, & J. Dawson.
214. W. E. Newton.
215. W. E. Newton.
218. Alexander Gray.
221. Thomas Dunn.
228. W. E. Newton.
235. Jozé Luis.
240. J. H. Johnson.
245. William Tait.
248. A. A. Larmuth.
250. W. E. Newton.
257. William Hartley.
261. Alex. Stoddart.
265. W. E. Newton.
267. Abdiel Hawkins.
277. W. H. Tooth.
285. Robert Adams.
288. Rudolph Bodmer.
289. W. E. Newton.
304. William Spurrier.
307. A. V. Newton.
312. J. W. Walton.
321. Auguste Prou-Gaillard.
326. W. E. Newton.
343. W. E. Newton.
367. H. D. Denison.
377. A. V. Newton.
402. W. E. Newton.
421. Courtenay Sprye.
428. Henry Widnell.
452. W. E. Newton.
472. F. H. Lemoine.
481. Thomas Lovelidge.
534. Alexander Melville.
617. Robert Pitt.
644. W. E. Newton.
757. F. C. Meyer.
784. Jabez Church.
803. G. F. Wilson.
808. Auguste Pentzlin.
821. William Richardson.
832. Ernest Stelzl.
866. E. T. Delafield.
873. Charles Dusautoy.
876. A. V. Newton.
902. H. Spence and J. G. Spence.
915. G. Addenbrooke and F. Lewis.
928. W. Burgess.
929. Thomas Fry.
935. M. A. F. Mennons.
950. W. H. Muntz.
958. Thomas Turner.
977. W. E. Newton.
984. James Willis.
991. T. G. Dawes.
1099. William Henderson.
1000. William Butlin.
1108. James Gardner.
1121. Daniel West.
1126. William Hunt.
1150. W. E. Newton.
1158. George Price.
1206. Charles Cowper.
1223. S. Holdsworth, J. and W. Henderson, and T. Bagley.

*** *For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

Evans' polishing thread.

Fig: 2.



[Lu]bricating.

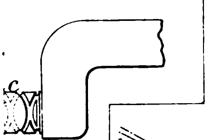
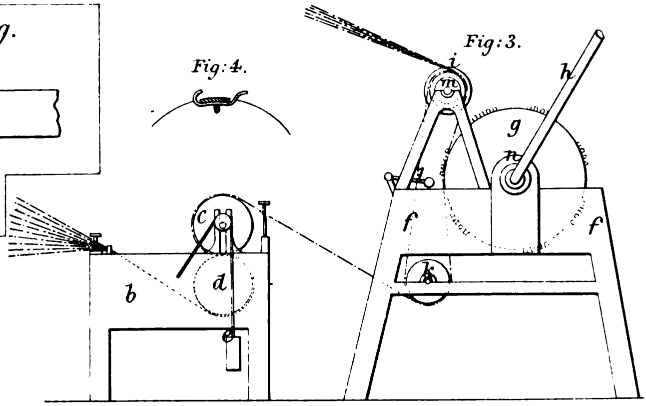


Fig: 4.

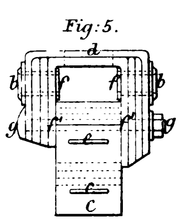
Fig: 3.

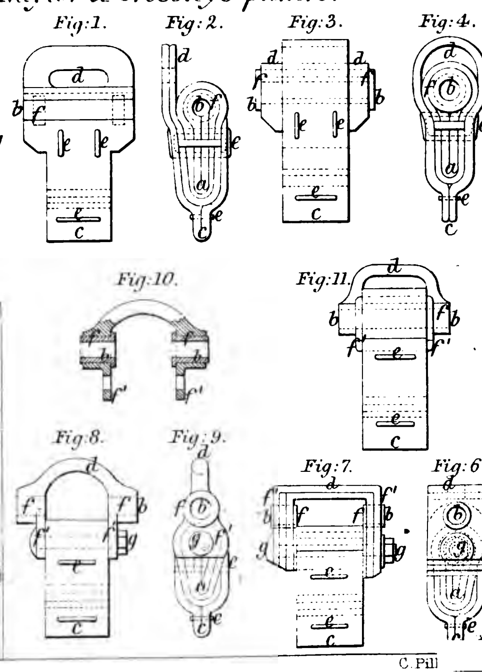


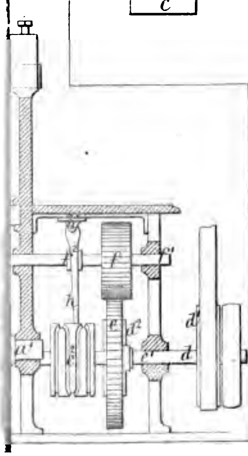
[...]orth's

Naylor & Crossley's pickers.

Fig: 5. Fig: 1. Fig: 2. Fig: 3. Fig: 4. Fig: 10. Fig: 11. Fig: 8. Fig: 9. Fig: 7. Fig: 6.



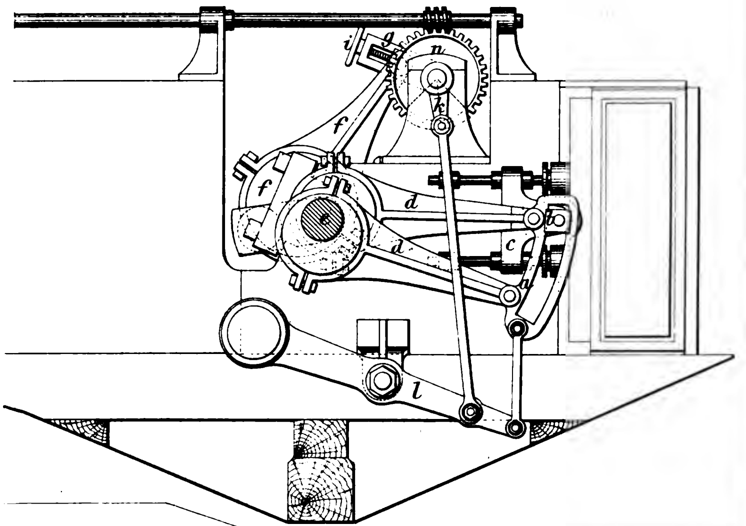


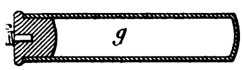


C. Pill

' engines.

Fig: 1.





Roberts' cigars.

Rae's cisterns.

Fig: 1.

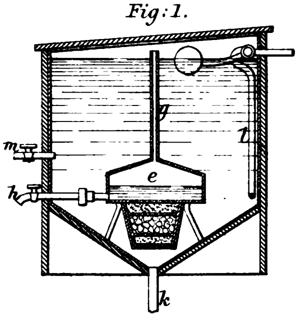
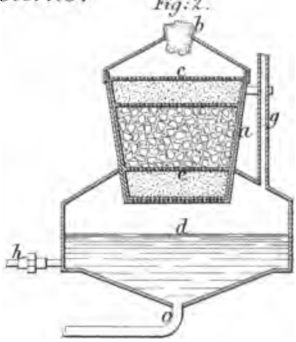


Fig: 2.



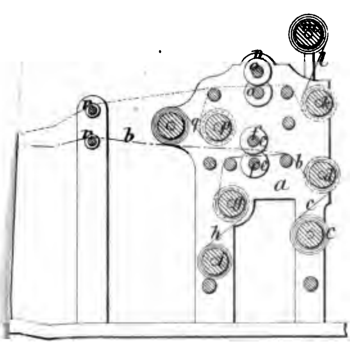


Fig: 5.

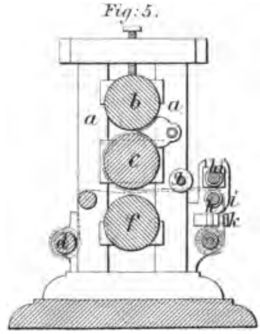


Fig: 3.

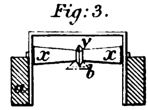
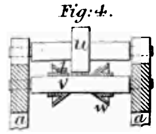


Fig: 4.



NEWTON'S

London Journal of Arts and Sciences.

No. LXIX. (NEW SERIES), September 1st, 1860.

REPORT OF THE COMMISSIONERS OF PATENTS FOR INVENTIONS FOR 1859.

By the Annual Report of the Patent Commissioners, recently presented to Parliament, we find that the financial condition of the Patent Office still continues to improve, and that at a rate far surpassing the estimated surplus revenue for 1859, given in last year's Report. The expenses of the Office—including compensations, fees to the law officers in lieu of salaries which should of right pertain to the offices of Attorney and Solicitor-General, and all matters relating exclusively to the administration of the department—amounted to £43,391. 6*s.* 3*d.*, while the gross income reached the unexampled sum of £96,804. 8*s.* 5*d.*; leaving a balance on the last year's transactions of £53,413. 2*s.* 2*d.* These are not the figures presented in the balance sheet, for under the plea that certain stamp duties were imposed by the Patent Act in lieu of the stamp duties formerly levied on patents, this large surplus is reduced in appearance by £17,725; that sum being supposed to belong to the consolidated fund; whereas the remainder is considered as disposable for the purposes of the Office. It is well, however, that patentees should understand the real state of the case, in order that they may know what proportion of the money paid for their patents is required to cover the expenses of the Office, and what ample funds remain available for other and kindred services, such as those which have been discussed of late, both in the press and by scientific societies. On a former occasion, we spoke of the desirableness of establishing a special tribunal for adjudicating upon matters relating to patents, and to smooth the way to its adoption we pointed out the means of defraying the cost of such a tribunal from the patent fund, without materially increasing the current expenses.*

The greatly increasing receipts of the office renders it comparatively easy, without disturbing existing arrangements, or interfering with that pet project of the Commissioners, the erection of a Patent Office, Free Library, and Museum, worthy of the manufacturing

* *See* Vol. X., p. 129.

and commercial greatness of the country—to found a tribunal for carrying out all the judicial requirements of the patent law. This tribunal (the idea of which has been long entertained), we considered, should not only administer justice in alleged cases of infringement, but also investigate applications for disclaimers and amendments of specifications. We find, however, that Mr. Grove, Q.C., has done us the honor to improve upon our suggestion; for in an elaborate communication to the *Jurist* (to which we have already had occasion to refer), he proposes to submit all applications for patents to "a Court consisting of one, two, or three judges," who, after advertising the applicant's claims, should hear him "on petition in open court, where any opponent should also be heard, and the merits of the invention thus discussed as far as they could be at such a stage. The judgment of the Court should be final, in reference to the two questions of invention being the subject of a patent, and as to its utility. The Court might also have the power to reject, upon clear evidence negativing the novelty of the invention," but without guaranteeing the validity of the patent on this point, if granted. With all due respect to the learned author of this suggestion, we think no scheme could have been proposed more unpalatable to inventors than this. For our own part, we would rather forego the benefits which such a Court would be calculated in other respects to confer, and see all the surplus funds of the Patent Office absorbed by the Chancellor of the Exchequer, than offer one word in favor of a project which would subject the untried schemes of intending patentees to such a scrutiny. Instead of an improvement on our present system, it would be a retrogression from the American system of examination, the workings of which have proved anything but satisfactory to that enterprising people. It might, possibly, if it did not crush inventive enterprise, provide a rich harvest for the leading patent agents and patent lawyers, but to no other portion of the community would it be of any advantage whatever. While noticing the subject of Mr. Grove's paper (which is itself somewhat of a digression from the direct matter in hand), we cannot pass without remark another suggestion which it contains, calculated, as it is, to mislead the uninformed, and, if acted upon, not merely to diminish materially the resources of the patent office, but to cut off from this country the immense benefits it at present enjoys, from being, in respect of scientific discoveries, the emporium of the world. Mr. Grove objects to foreign inventors having any encouragement held out to them to domicile themselves here, or in any way to become interested in the development of invention in any country but their own. He considers that if there be any merit at all due to an importer of any the most important discovery in the arts, that merit equally belongs to

the postman (!) who has been the medium of its introduction. On this head, he says,—"An invention in France is sure to reach this country by the next post, or to appear in full in the next number of the *Athenæum*, *Literary Gazette*, or *Mechanics' Magazine;* and the importer who posts over from the foreign inventor to anticipate these publications and to take out a patent, injures instead of benefits the public —stops, instead of promotes, the progress of discovery—has no merit of his own, but the demerit of monopolizing an invention which he has not made; and yet he gets a patent for fourteen years. The postman who brings a letter from a foreign patentee as much deserves patent as the correspondent to whom it is directed." Let us accept this suggestion for the nonce, and put it into form, employing, in illustration, the Daguerrreotye case, which Mr. Grove himself cites, and we shall then have such an application for presentation to the patent office as the following, viz., "To the Queen's most Excellent Majesty—The humble petition of Miles Berry, patent-agent, and — Walker, twopenny postman, Showeth, that in consequence of a communication from Louis Daguerre, of Paris, your petitioners are in possession of an invention for 'the spontaneous reproduction of all the images received in the focus of the camera obscura,' which invention, they believe, will be of great public utility." A fortunate thing would it be for this underpaid class of public servants to get the chance of sharing in the profits of valuable patents, but we cannot follow the reasoning which places their claim on an equal footing with the trustee of an illustrious inventor. Mr. Grove is not perhaps aware of the numerical importance of imported inventions. We find that in the past year, during which 3000 applications for patents were lodged, no less a number than 561 were for foreign inventions, which included, we need scarcely remark, the most important of the patented inventions of Europe and America. If these importations really tend to stop, instead of promoting, the progress of discovery, we must personally have incurred a frightful amount of responsibility; but our consolation is, that this is the very reverse of the fact; for never would the ingenuity thus introduced be available to this country, except for the protecting ægis of the patent law. Inventions, we can assure Mr. Groove—who being a philosopher will appreciate the simile—are, when first brought into the world, very like puppies, blind and helpless, and they require a vast amount of parental care to ensure their arrival at maturity. Ingenious men may throw off inventions with as little trouble as a hen may lay eggs, but unless they receive the parental warmth, and that in no fitful manner, but persistently, they will never come out of the shell of obscurity and see the light of day. They will, in fact, be as hopelessly lost to their author and the world as so many eggs laid broad-

cast and neglected. But to return to the Report of the Commissioners.

The receipts, we have said, for the year 1859, were £96,804. 8*s*. 5*d*., a portion of which was derived from the sale of the Commissioners' publications. To the progress of this, the mercantile department of the Patent Office, our attention has been annually directed, and we now again present our customary summary of the receipts and expenditure, on this head, since the Act of 1852 came into operation. The publications, it will be remembered, consist not merely of the specifications of all English patents, from the earliest period to the present time, but also of indexes, chronological, alphabetical, and analogical, short abstracts of specifications, arranged according to their subject matter, and a weekly journal, containing lists of new patents, British and foreign patent laws, and other matters of interest to inventors. The cost at which these several publications has been produced, extending over a period of something more than seven years, or from October, 1852, to December, 1859, is, exclusive of the literary and professional labour expended on them, as follows:—

			£.	s.	d.
From 1st October, 1852, to 31st December, 1853.		Printing specifications, &c., lithographing drawings, and paper for same	12,020	7	9
For the year ending	1854	ditto	42,208	6	9
Ditto	1855	ditto	25,777	8	8
Ditto	1856	ditto	39,880	13	7
Ditto	1857	ditto	47,667	3	8
Ditto	1858	ditto	30,656	1	3
Ditto	1859	ditto	15,776	7	7
Making a total outlay for printing, lithographing, and paper, of			£213,986	9	3

During the same period the credits on the sale of the specifications and indexes were as under:—

Amount received to the end of the year	1853 (estimated at)		£500	0	0
Ditto for the year ending	1854, official return		834	14	0
Ditto ditto	1855,	ditto	1236	15	2
Ditto ditto	1856,	ditto	1361	10	0
Ditto ditto	1857,	ditto	1463	16	11
Ditto ditto	1858,	ditto	1371	2	0
Ditto ditto	1859,	ditto	1682	3	1
Total obtained from sale of Commissioners' publications			£8450	1	2

If, now, we subtract the receipts from the expenditure, we obtain the following result, viz:—

Cost of publications	£213,986	9	3
Realised by Sale	8,450	1	2
	£205,536	8	1

It is a matter for congratulation that the loss on the last year's business (£14,094. 4*s*. 6*d*.) contrasts so favorably with that of preceding years.

This is occasioned, in part, by a slight increase (£311) in the sale of the publications, but principally by a reduction to little more than one half, as compared with the year 1858, of the cost of printing, lithographing, and paper. How this reduction has been effected we know not, for the number of specifications required to be printed has been maintained; the zeal for issuing abstracts of the specifications has however manifestly abated: we trust this change has not arisen from our strictures on the manner of their production, for the design is very laudable, and one which patentees may well expect to see properly carried out. With respect to the amount realised by the sale of the publications, we still retain the opinion which has frequently been expressed in this journal, that by proper arrangements it might be greatly increased to the benefit, not only of the patent fund, but to those for whom the printed specifications and indexes are specially intended; their utility being obviously governed by the extent of their circulation.

It is, however, extremely satisfactory to find, that in spite of the many expenses, not properly belonging to the office, with which the patent fund is saddled—as, providing for the unnecessarily large deficiency in the receipts on the sale of the Commissioners' publications, paying the salaries of the Attorneys and Solicitors General for England and Ireland, and the Lord Advocate for Scotland, and their several clerks, and compensating sinecurists, under the old patent system—the surplus revenue is rapidly increasing. On this point there can be no mistake, for the Commissioners' annual reports, although to some extent mystifying the fact, in the way above mentioned, yet present the following unquestionable results:—

			Surplus.			Deficit.		
For One Year and a Quarter ending December 31st, 1853		... ...	£25,311	15	9			
For the year ending	1854	... ...				9639	10	4
Ditto	1855	when the £50 taxes first became due	23,076	10	4			
Ditto	1856	... ...	26,714	15	5			
Ditto	1857	... ...	7,601	14	0			
Ditto	1858	... ...	23,164	11	2			
Ditto	1859	when the £100 taxes first became due	52,406	2	2			
		Total	158,275	8	10			
		Less deficit	9,639	10	4			
Total surplus Income of the Patent Office ...			£148,635	18	6			

With respect to the accruing surplus revenue, the Commissioners consider it would not be expedient to dissipate it by reducing the amount of periodical payments due on patents, "so long as the surplus can be expended for the benefit of patentees and that portion of the community which is principally interested in, and connected with,

the practical application to public purposes of discoveries and improvements in science and art." So far we agree with the Commissioners, but we think it highly desirable that the facilities for paying these taxes should be increased, so that patents should not be hopelessly sacrificed through misadventure or forgetfulness. And, as regards the existing surplus, they believe it might be beneficially applied in "the purchase of ground in a central situation, and in the erection thereon of a sufficiently spacious fireproof building for the Patent Offices and Public Free Library attached thereto; and also in the purchase of ground, and the erection thereon of a permanent and spacious building for the Patent Office Museum; sufficient ground being taken for the extension of the building from time to time, as may be required." To the appropriation, to these purposes, of the surplus revenue, no patentee could reasonably object; but, after providing amply for these, there would appear to remain sufficient funds for maintaining a special Court for trying patent causes, which, to quote from Mr. Grove's paper, above referred to, "has been frequently discussed and viewed with favor by many members of the Bar, has been alluded to by judges from the Bench, and has been not unfavorably regarded by patent agents, attorneys, and others conversant with patent cases." Our own experience tells us that it would be the greatest boon that has ever been conferred on patentees, for, with a proper tribunal, such costly and prolonged suits as that, the final stage of which is reported in our present number,* could not occur; the salient points of the case would have been at once appreciated, and the plaintiff put out of court without a witness being called for the defence. Had this cause not been pushed to extremity, it would have ended with the same injustice to the defendants as some others, previously reported in this Journal, that commenced under similar auspices. Indeed, so perplexing and distracting has been the course of "justice" of late, with respect to adjudications on patents, that not a few who have given this branch of law their serious consideration would subscribe with us to the following remark of Mr. Grove, "From the general opinion in favour of a special court, which I have from time to time heard expressed by those conversant with the subject, and from the general dissatisfaction existing with regard to the present system, I have little doubt that the time will come when *either a special court will be established, or patent law altogether abolished.*" One or other of these courses appears to us obvious; for a law that cannot be properly administered should certainly be repealed. Let us not however hastily decide, that because common law judges and special juries have not been found able to cope with all the intricacies involved in questions of practical science, that therefore these are

* Seed *v.* Higgins, *see* p. 178.

unfathomable; as, for our own part, we have never yet discovered in any patent case a difficulty that could not be readily solved by a mind of ordinary capacity, which, superadded to legal training, has been initiated into the mysteries of practical science.

RECENT PATENTS.

To ALEXANDER CHAPLIN, *of Glasgow, for improvements in engines for drawing or conveying heavy loads.*—[Dated 18th January, 1860.]

THIS invention consists, in the first place, in applying to self-propelling traction engines mechanism for hauling forward the load by means of a rope or chain.

A simple mode of carrying out this improvement consists in arranging a winding barrel upon the axle of, or in connection with, the propelling wheels of the engine. When the engine is unable to draw its load in the ordinary way, in consequence, for example, of the road being up-hill or rough, the engine is moved on alone in advance, and the propelling wheels being raised off the ground by means of crutches, or otherwise, and the hauling rope being connected to the load, the engine is made to haul the latter up to it; whereupon it may, if required, move on a further stage in advance, and again haul the load up to it.

According to another modification, the winding barrel and its gearing may be independent of the propelling wheels, in which case these will not require to be raised off the ground when hauling is needed. Thus, if the winding barrel is retained upon the axle of the propelling wheels, the latter may be driven by clutches, capable of being thrown out of gear when it is wished to wind up the hauling rope or chain without moving the carriage. The winding barrel may, however, be arranged independently of the propelling wheels or their axle, and ordinary clutches, or frictional gear, may be used for working either independently. Instead of the engine being stopped, and hauling the load up to it, the rope or chain may be carried forward and fixed in advance, and the engine may be made to draw or haul itself, or itself and the load, by means of the rope or chain so fixed.

The invention also relates to the constructing of engines to act either as traction or hauling engines, or by carrying the load. To this end the frame is made of extra length, one end or portion of it being intended for the load, whilst the engine is mounted at the other end. It is preferred to arrange and construct the engine and boiler details according to the plans, or modifications of the plans, described under the patents granted to the present inventor, and bearing dates respectively 26th December, 1857, and 7th April, 1859.

The patentee claims, "the applying to or using in a self-propelling traction engine of mechanism for drawing or hauling a load towards the engine, or the engine and load towards a fixed point, and the constructing of a traction engine so as to be capable of either drawing, hauling, or carrying the load, substantially as described.

To HARRISON BLAIR, *of Farnworth, Lancashire, for improvements in the production of carbonic acid gas.*—[Dated 19th January, 1860.]

CARBONIC acid gas is now much used in the arts and manufactures, and where required pure, or unmixed with other gases, for such purposes, has hitherto been produced by the decomposition of limestone, by means of an acid, chiefly sulphuric or hydrochloric; the employment of such acids being attended with considerable cost, whilst the residue (sulphate or hydrochloride of lime) is of comparatively little value. The object of this invention is to avoid the employment of acids for the decomposition of limestone, thereby materially reducing the cost in the production of carbonic acid gas for manufactures, and to leave a valuable residuum, namely, caustic lime, which may be applied to the purposes in which caustic lime is generally used, the agents employed for that purpose being heat and the vapour of water (steam).

The apparatus used consists of fireclay retorts or pipes, seven feet long, and fifteen inches in diameter, open at both ends, to which are adapted cast-iron mouth-pieces, with covers provided with set screws, as those used in the manufacture of coal gas. Each mouth-piece is also furnished with a two-inch diameter cast-iron branch; that at the back of the retort is for the admission of steam, and that at the other end or front, for the emission of gas and vapour. Three or more of these retorts may be placed in an oven or furnace, similar to those used in coal gas works, and heated by coke or coals. The steam, before admission into the retorts, is superheated, by being caused to pass through iron pipes, embedded in the brickwork between the ovens, and down the brickwork of the back of the oven, to the branch in the mouth-piece (the branches being on the upper side of the mouth-pieces), the tap for the regulation of the admission of steam being placed at the front side of the oven, to be handy for the workmen. It is not desirable to heat the steam to redness in cast-iron pipes, as in that case hydrogen is evolved, which has an injurious action on the carbonic acid for subsequent use. The following is the mode of operation:—The oven is first slowly heated, in order to avoid fracture of the retorts, and when at a red heat is charged at the front end with from one and a half to two hundredweight of limestone, broken to about an inch cube, and the covers secured with slacked lime, and screwed fast: when at a red heat, steam may be admitted. A half-inch lap, if the pressure of steam be equal to ten or twelve pounds on the square inch, will be sufficient, and carbonic acid gas will be evolved. At the end of four hours the charge may be shoved towards the back end of the retort, and a fresh charge introduced. In about four hours more, the first charge may be drawn at the back, the charge then in the retort shoved back, and a charge again placed in the front, so that there will be always two charges being operated upon in the retorts. The gas emitted is mixed with aqueous vapour, which, if requisite, may be separated by being cooled in condensers similar to those used in coal gas works for the same purpose.

The patentee claims, "the production of carbonic acid gas, for the aforesaid purposes, by treating carbonate of lime or other suitable carbonate, within a closed vessel and in a heated state, with the vapour of water.

To JOHN FISHER, *of Carrington, Nottinghamshire, for improvements in machinery or apparatus for washing, cleansing, or purifying clothes and other articles.*—[Dated 5th January, 1860.]

THIS invention consists in combining with a tub or other suitable vessel for containing the articles to be washed, a blowing apparatus for forcing atmospheric air or any suitable gas for depuriating, bleaching, or otherwise treating the contents of the tub or vessel, whether soap ley, plain or acidulated water, or other liquor be employed. For household or laundry purposes, this apparatus is worked in the following manner:—The tub or vessel is partially filled with hot water, and the soap or cleansing mixture put thereinto; the clothes or articles to be cleaned are then placed in the vessel, and the cover being put on, the blowing apparatus is set in motion, and air is forced through the liquor, and the articles contained therein. This operation is continued until the required amount of cleansing or washing has been effected, when the articles may be removed from the tub or vessel. When rinsing or washing off in plain or slightly blued water has to be performed, for the purpose of finishing articles of white linen, cotton, and other articles, the requisite amount of water, either pure, or blued or otherwise charged, is put into the tub or vessel, and the blowing commenced and continued as before.

The figure in Plate VI., exhibits a side elevation of the improved machine. *a*, is a hand wheel for working the apparatus; *b*, a half crank; *c*, a connecting-rod, working on the pin of the half crank, and attached at the lower end to a forked arm *e*, giving motion to a vibrating bar, pivotted in the side framing supporting the working parts of the apparatus; to this bar are attached three projecting forked arms *e*, and *f*, *f*: these arms form part of the bar with which they vibrate. *g*, *g*, are rods, attached to their lower extremity to the forked end of the arms *f*, *f*, and at their upper extremity to studs projecting from a plate *h*, which is secured to the bottom of the bellows *j*: *k*, is a pipe, down which the air or gas forced from the bellows passes to the under side of the tub or vessel containing the clothes to be washed. From the main blast-pipe *k*, are led a series of small branch tubes, as shown,—each tube having a nozzle *l*, at its extremity passing through the bottom of the vessel, through which nozzles *l*, *l*, the air enters, and is forced into and amongst the liquid and clothes contained therein, thus causing the ebullition of the liquid and the agitation of the clothes immersed therein, by which they become thoroughly cleansed without injury. *m*, is a cock for the discharge of the liquid from the vessel.

When washing with these machines, the tub is filled nearly three parts full of soft water, at about 90° Fahr.; the clothes are then put into the tub (without being previously soaked), and the dirty places rubbed with a little soap, then pressed into the water, care being taken to have them well covered, and not more in than can be freely moved about by the hand. The cover being put on the vessel, the blowing apparatus is set in motion by the lever or handle, and the air is forced through the liquid contents, and through and amongst the clothes, this operation being continued for ten or fifteen minutes, when the articles may be wrung out and laid on one side until ready to do them a second time in clean water, at about the same heat as before: the apparatus being worked about ten minutes, the clothes will be found perfectly clean; they may then be scalded or boiled in the

ordinary manner. It is advisable to remove the cover after working the apparatus, and move the articles about a little by one hand, while turning with the other; this also prevents the clothes rising over the sides of the tub. When all the dirt is not removed after the first washing, a little soap must be used upon the dirty places after being wrung; this will soften the dirt, and the air will then entirely remove it; care must be taken not to charge the tub to such an extent that neither the air nor water can act upon the clothes. The process of rinsing with fresh water, clean or slightly blued, according to the description of articles under operation, may be gone through in precisely the same manner.

The patentee claims, "First,—the use or employment of atmospheric air or other gas for washing, cleansing, purifying, bleaching, or otherwise treating clothes or other articles, or piece goods, or raw or manufactured materials, in manner described and herein set forth. Second,—the construction and mode of working machines, as herein described, for the purpose of washing, cleansing, and purifying clothes and other articles and goods."

To HENRY CHANCE, *of Birmingham, and* THOMAS HOWELL, *of Smethwick, Staffordshire, for improvements in the manufacture of glass.*—[Dated 7th January, 1860.]

IN the manufacture of certain kinds of glass, it has been found desirable not only that the melting process should take place in a covered pot, but likewise that the melted glass should be poured out or cast from a covered pot, whether such casting be upon a surface or into moulds or vessels. Now this invention relates to the employment of a covered pot, not only in melting, but also in pouring out or casting glass.

The figure in Plate VI., shows a view of a pot or vessel of the form preferred. *a*, is the pot, having an opening at *b*, which is closed by an inside and outside stopper when the glass is being melted, as is usual when melting glass in covered pots. When the glass is melted and ready for casting, the two stoppers are removed, and the glass being "skimmed" in the usual manner, the pot is taken out of the furnace in the same way as open pots are now removed when casting plate glass, there being a groove or recess formed on the exterior of the pot, around which the pot is clipped by the instrument used to remove it. Just before the pot is inclined, in order to pour out its contents, the mouth-piece *c*, which should be made of copper, is inserted into the opening, and the joint made tight. This mouth-piece is for the purpose of separating the glass from the inside of this opening, and of facilitating the pouring out of the glass, and it is furnished with a shield of iron or other suitable material, as shown, for the purpose of preventing anything, such as bits of clay or other matter, from falling from the upper part of the pot upon the glass which is poured out.

To EDWARD DORSETT, *of Old Broad-street, for a new manufacture of heavy oil.*—[Dated 30th November, 1859.]

IN the manufacture of certain descriptions of artificial fuel, the materials are exposed to heat in retorts, and the vapors or gases arising therein

allowed to escape into the air, to the annoyance of the surrounding neighbourhood. Instead of allowing the vapors or gases, so given off in the manufacture of artificial fuel, to escape into the air, the patentee proposes to convey such vapors from the retorts, ovens, or stills, through pipes in a condensing tank or refrigerator to any suitable receiver, by which process they will become condensed, and produce a large amount of heavy oil.

In Plate VI., fig. 1, is an end elevation, fig. 2, a transverse section, and fig. 3, a longitudinal section, of the apparatus employed to collect the product of the gases from a retort or oven charged with the materials for making artificial fuel. The materials are placed in the usual manner in the body of the ordinary retort or oven *a*, having at both ends the doors *b*, which are closed with the bars *c*, by means of the lugs *d*, and wedges *e*, the joints of the doors being afterwards luted to the frame with clay. The vapors or gases, as they are given off, pass through pipes *f*, connecting the retort with the main conducting pipe *g*, through which the gases pass onward to the condensing pipe *h*, placed in the condensing tank *i*, the effect of which is to condense the vapors or gases into a heavy oil, which falls into the cistern or receiver *k*. The pipes are furnished with caps *l*, which can be removed when the pipes require clearing, but are fitted tight when the apparatus is in operation. The cock *m*, is employed for regulating the quantity of water in the condensing tank *i*.

The patentee claims, "the manufacture of heavy oil, by condensing the vapors or gases given off in the manufacture of artificial fuel in retorts, as above described."

To THOMAS WILLIAM PLUM, *of Blaenavon Iron Works, Monmouthshire, for improvements in the manufacture of tyres for railway and other carriage wheels, and of hoops and rings, and in machinery employed therein.*—[Dated 17th December, 1859.]

THIS invention consists in preparing "scarf" joints on the ends, or in scarfing the ends of bars of metal, which ends are afterwards to be brought together and welded to form tyres for railway carriage and other wheels, hoops, and rings. For this purpose, a tyre bar is forged or rolled in the ordinary manner, and while hot, at any point of the manufacture, before the bar is brought to its finished section, the ends are prepared for welding, by scarfing or cutting them into correspondingly zig-zag or irregular forms to make a scarf joint. The machinery employed for this purpose is a circular saw or a rotatory or other suitable cutting apparatus, while the bar is in a cold or a hot state, as found most convenient; the bar is then reheated, or not, and the scarfed ends are brought together ready for welding. The ends of the bar are brought to a welding heat, and are welded together by hammering and rolling, or either. When rolled, a machine similar to that used for bending and blocking tyres, is employed; the rollers being made sufficiently strong, and driven at a speed suitable for completing the weld and bringing the tyre to its finished section.

In Plate VI., fig. 1, is a side view of part of a bar of metal, showing the ends of the bar scarfed or cut into a zig-zag form, in the manner before described; and fig. 2, is a view of the same bar, bent into the form of a tyre, with the ends brought together ready for welding.

The patentee claims, "First,—preparing a scarf or cut of an irregular or

zig-zag figure upon the ends of bars, for the purpose of welding when the bar is bent and the ends brought together and welded to form tyres for wheels, and hoops, and rings. Second,—the employment, in the manufacture of such tyres, hoops, and rings, of tyre bending and blocking machines, in which the rollers are strengthened and driven at a quick speed suitable for finishing the weld."

To RICHARD STEAD HOWDEN *and* EDWIN THRESH, *both of Wakefield, Yorkshire, for an improved construction of safety lamp.*—[Dated 20th December, 1859.]

THIS invention relates to a novel construction of lamp for the use of miners, the object being to increase the efficiency of the Davy or safety lamp, and render it less liable than heretofore, in careless hands, to ignite the fire-damp in coal mines.

The figure in Plate VI., is a vertical section of the improved lamp, in which a tubular wick is substituted for the ordinary solid wick; an air supply being made through the oil chamber or reservoir as in the ordinary Argand lamp. Below the central opening in the oil chamber wire-gauze diaphragms are placed, at a short distance apart, for the purpose of cutting off the communication between the interior of the lamp and the outer atmosphere. In other respects, the lamp is very similar to those generally in use. *a, a,* is the oil chamber, the sides of which are continued downwards, to form the foot of the lamp. A ring of holes *b, b, b,* is made around the foot of the lamp, to ensure access of air to the interior. *c,* is an open tube, extending upwards through the oil chamber to near the level of the wick. Concentric with this tube is a wick-holder *d,* which is raised and lowered as desired by an adjusting screw *e,* which is supported by a shoulder fitting into the top of the oil chamber. The middle part of the top of this chamber is recessed, and the edge of the recess has a screw cut upon it, to enable it to receive a screwed collar *f,* which carries the upper part or cover of the lamp that surrounds and encloses the flame. This cover is composed, as usual, of a wire-gauze cylinder *g,* with strengthening rods, and a cap *h,* to which the suspending ring is attached. Between the collar *f,* and the top of the oil chamber, the nozzle *i,* is secured, which, with the tube *c,* forms an annular space for the wick to pass up. The wire-gauze diaphragms are shown at *k, k,* situate immediately below the oil chamber, and divided from each other by a loose metal collar. These diaphragms are held securely in place by means of a threaded ring *l,* which screws into a thread cut on the inner face of the foot of the lamp. Access is gained to the wick and oil chamber by detaching the upper part of the lamp from the lower end in the usual manner.

It will now be understood, that the air to supply combustion will, when the lamp is standing on the ground, enter the holes *b,* at the foot of the lamp, pass through the diaphragms, and up the central tube *c,* to the flame. An ample supply of air will thus be ensured to the flame sufficient to keep up a large bright light, while at the same time the possibility of the flame igniting fire-damp outside the lamp is effectually avoided.

The patentees claim, "the means above described for ensuring with safety a copious supply of air to the flame of miners' lamps."

To THOMAS STOKES CRESSY, *of Burton-on-Trent, for improvements in trussing casks, and in apparatus employed therein.*—[Dated 29th December, 1859.]

IN Plate VI., fig. 1, shows a vertical section of a machine for trussing casks constructed according to this invention. *a*, is the bed-plate of the machine, from which a standard *b*, rises. Within the standard is a screw *c*, that passes through a nut *d*, furnished with a flange at its top, which rests on the ring *e*, screwed down to the bed-plate. On the lower part of the nut *d*, is the worm-wheel *f*, in gear with a worm *g*, capable of being driven by a pulley and strap, or otherwise. Between the worm-wheel *f*, and the bed-plate, friction balls are placed in grooves turned for them, to prevent friction between these two parts. The lower end of the screw *c*, is keyed in a socket formed for it in the plate *h*, so that when the nut *d*, is turned, the plate *h*, is raised or lowered, and it is kept always truly parallel with the bed-plate *a*, by guides *i*, *i*. To the plate *h*, links *j*, *j*, are jointed; there may be eight or other convenient number of these links arranged at equal distances apart around the plate *h*. The upper ends of the links *j*, *j*, are furnished with hooks, which hook on to pins k^1, on the levers *k*, (a plan of one of these levers is also shown at fig. 2). These levers, at their upper ends, carry circular arcs k^2, of the same radius, or thereabouts, as the circle into which the staves of the cask have to be drawn; at their other ends they have slots k^3, formed in them, through which pins a^1, fixed in projections from the bed-plate *a*, pass. a^2, are other pins, carried by projections from the under side of the bed-plate, and the levers *k*, are furnished with arms which abut on the said pins. The levers *k*, are mounted in this manner, so that, when out of use, they may be detached from the links *j*, and turned back out of the way, to allow the cask to be trussed to be placed between them; when at work, the levers turn on the pins a^2, as on axes. *l*, is a fire-basket, to contain a fire to heat and soften the staves during the operation of trussing; *m*, *m*, are the staves of a cask set up in the hoops *n*, *n*, and inverted over the standard; *o*, is a cross-bar, to keep the cask from rising during the trussing; the cross-bar is secured by a key, as shown. When the parts are in the position indicated by the figure, the screw *c*, is put in motion, and it draws down the levers *k*, and the lower hoop *n*, until the arcs k^2, begin themselves to bear on the staves, and then this hoop falls off, and the levers bend the staves further inwards until they are brought close together at the bottom: A jointed hoop is then clasped on to the cask, immediately over the levers; the cross-bar *o*, is taken off, and the cask is removed, and finished in the usual manner.

To JAMES SLACK, *of Nottingham, for improvements in water and steam-gauges for steam-boilers.*—[Dated 30th December, 1859.]

IN Plate VI., fig. 1, shows a front view of a water-gauge constructed according to this invention. *a*, *a*, is a tube, having small holes *b*, *b*, formed therein at regulated intervals; *c*, *c*, are two cocks applied thereto, and suitably formed for being fixed to a steam-boiler, so that one of the cocks may be fixed below the correct water-line of the boiler, and the other above it; *d*, is a cock at the lower end of the tube *a*. When it is de-

sired to ascertain the height of water in the boiler, the upper cock *c*, is opened, and then the lower cock *c*, is opened, the cock *d*, being closed; the water will then flow through those holes *b*, of the tube which are below the water level in the boiler.

Fig. 2, shows a transverse section of another arrangement of water-gauge, wherein an unperforated metal tube or tubes is used on the interior of the boiler, which, being connected at one end to the end of a hollow plug of a cock, so that it will rotate therewith, will indicate the height of water in the boiler, when the plug of the cock is rotated by its position, when its lower end first enters or leaves the water in the boiler. *e*, is the tube, which, at its upper end, is fixed to, or forms part of, the plug *f*, of the cock *g*, which is made suitable for being fixed to a steam-boiler by the screw *h*, or otherwise; *i*, is the handle or pointer, fixed to the plug, and *j*, is a dial-plate. The plug *f*, is made with an opening *k*, which, when the pointer is moved round a short distance, communicates with the groove *l*, partly around the interior of the body of the cock. *m*, is an outlet pipe connected to the body of the cock. When the pointer *i*, is in a vertical position, the passage through the plug of the cock is closed; but when the pointer is inclined in either direction, the passage will be opened, and if the bottom of the pipe *e*, is below the water in the boiler, water will escape through the outlet *m*; but by continuing to incline the pointer more and more, until steam commences to escape through the outlet, the height of the water in the boiler may be ascertained.

Fig. 3, shows a section of a pressure-gauge constructed according to this invention. *n*, is a zig-zag spring, having at its lower end a piston *o*, which works in the short cylinder *p*; the upper end of the cylinder *p*, is contracted at *q*, so as to prevent the piston being forced too far by the pressure thereon. *r*, is a flexible diaphragm which closes that end of the cylinder *p*, fluid-tight; *s*, is a link or connecting-rod, attached at one end to the lower end of the zig-zag spring, and at the other end to a toothed quadrant *t*, which acts on a pinion on the axis of the pointer hand, which indicates the pressure on the outside by a graduated face.

The patentee claims, "First,—the combined apparatus described in respect to fig. 1. Secondly,—the mode of applying a tube *e*, to indicate the height of water in a boiler. And, Thirdly,—the combined apparatus described in respect to fig. 3."

To THOMAS BOLTON, JOHN BERTENSHAW, *and* JAMES MCCONNELL, *all of Bolton-le-Moors, Lancashire, for certain improvements in machinery or apparatus for roving, slubbing, spinning, and doubling cotton and other fibrous materials.*—[Dated 14th December, 1859.]

THIS invention relates to all machines wherein spindles and flyers are employed for roving, slubbing, or doubling cotton and other fibrous materials or substances, and consists in the novel application or adaptation of pieces of metal or other material placed vertically between the spindles, so as to form slight partitions between the spindles. By this improvement, if the thread or sliver breaks, the loose end thereof is confined to its particular spindle, instead of being allowed to come into contact with and run double or wrap around the next or adjoining spindle, whereby much

waste of material is at present caused; or a pin or stud may be placed upon the shoulder of the flyer for the same or a similar purpose.

In Plate V., fig. 1, is a front view of a doubling frame; and fig. 2 is an end view of the same, shown partly in section. *a, a,* is the framing of the machine; and *b, b,* are the spindles, between which the partitions *c, c,* are placed, to prevent any broken sliver from becoming entangled with the next spindle. In fig. 1, a spindle is shown, having a pin or stud *d,* upon one shoulder for a similar purpose.

The patentees claim, "the novel application and use of vertical partitions or guards between the spindles in machines employed for roving, slubbing, spinning, or doubling. And, Secondly,—the application of a pin or stud to one shoulder of the flyer, both such improvements being contrived or intended to prevent the loose end of a broken sliver or thread becoming entangled or interfering with the adjoining spindle, as described."

To EDWARD PILKINGTON HOLDEN, *of Bolton-le-Moors, Lancashire, for improvements in machinery for opening, carding, and cleaning cotton and other fibrous materials, when in a manufactured or partially manufactured state.*—[Dated 16th December, 1859.]

THIS invention is chiefly applicable in the manufacture of waste for cleaning machinery, and for other purposes, and it consists in causing the cotton or other fibrous materials, of which the waste is to be made, to pass through a machine similar to a carding engine, but with drums and rollers covered with very strong card fillet, or with spikes or teeth: the material, which usually consists of the ends of cops, or of pieces of fabric, or of shoddy, or of a mixture thereof, is fed into the machine, and after being opened, carded, and cleaned by the working rollers, is delivered by a doffer, as in other carding engines, thereby effecting a considerable saving in the manufacture of waste, or in opening, carding, and cleaning cotton and other fibrous materials, for paper makers, or for other purposes.

The figure in Plate V., is a section of the improved machine. *a,* is the feeding apron, passing over the rollers *b,* and *c,* on to which apron the ends of cops, or other material to be converted into waste, are fed, and by which they are carried forward to the feeding rollers *d,* and *e*; *f,* is the clearer, which clears the under feed roller *e,* and delivers the material to the small drum *g*; this drum revolves in the direction of the arrow, and is provided underneath with a grid *h,* through which a great portion of the dirt and dust, which is loosened by the action of the drum *g,* escapes; the drum *g,* delivers the materials to the main drum *i,* which carries them forward, and deposits them on the doffer roller *j,* after they have been opened, carded, and cleaned by the action of the workers *k, k, k,* and clearers *l, l, l.* The rollers and drums *d, e, f, g, i, j, k,* and *l,* are all covered with strong card fillet, or fine spikes or teeth. The tin roller *m,* placed partly under the main drum *i,* and doffer *j,* serves to prevent the materials dropping on the floor, or accumulating on the main drum *i.* When the materials are deposited on the doffer, they are converted into the article of commerce known as cleaning waste, which is extensively used in all machine-making establishments for cleaning purposes. The waste is removed from the circumference of the doffer by the rollers *n,* and *o,* the latter of which is of polished iron or other metal, and the

former, which is weighted, is made by preference of wood, covered with felt and leather; the waste, after passing between the rollers *n*, and *o*, is delivered to the roller *p*, which is covered with vulcanized India-rubber or other suitable material, and it is then formed into a lap, as shown at *q*; the roller *p*, serves also to clear the surface of the roller *o*. When the lap roller is full, it is removed from the machine, and an empty one put in its place.

In the machines hitherto employed for manufacturing cleaning waste, drums, with long curved spikes, are employed; the materials of which the waste is made are fed in until the spaces between the spikes are filled up; the machine is then stopped, and the waste is removed by cutting across the layer of waste, and reversing the motion of the drum, thereby causing a great loss of time, whereas, according to these improvements, the supply of the materials and the delivery of the waste is continuous.

The patentee claims, "the improved combination of machinery shown and described, or any mere modification thereof, for opening, carding, and cleaning cotton and other fibrous materials when in a manufactured or partially manufactured state."

To EDWARD KIRBY, *of Oldham, Lancashire, for certain improvements in, or applicable to machines, for spinning, doubling, winding, reeling, and weaving, and in cop tubes used in such machines.*—[Dated 29th December, 1859.]

THIS invention consists in applying to the spindles of spinning and doubling machines, and to the skewers of machines for winding and reeling, and to the skewers of shuttles used in weaving, a conical piece of wood, metal, paper, or other suitable material, of the form of the nose of the cop to be made, by using which the shaping-plate of the copping motion may be of a plain diagonal form, corresponding to the taper of the nose of the cop, thereby dispensing with the machinery now required for building the bottom of the cop. In some cases, the conical piece is connected with a tube of the length, or part of the length, of the cop. In order to overcome the difficulty now experienced in removing the coils of yarn which are wound on the spindles below the ordinary cop tubes, wire hooks are applied to the lower part of the conical pieces above referred to, around which the yarn is coiled when the cops are completed. These wire hooks or other substitutes enable the attendant to cut the yarn, and then remove it with facility.

The invention also consists in applying hooks or their substitutes to the rings or braids now used in connection with the ordinary cop tubes. The skewers of machines for winding, reeling, and weaving, are also furnished with conical pieces of wood or other material, corresponding in shape to those used in the spinning and doubling machines.

Another part of the invention consists in driving the spindles of spinning and doubling machines by means of double-grooved wharves, or of two wharves placed near each other on the same spindle.

In Plate VI., fig. 1, is an elevation of part of a mule spindle to which the improvements are applied; the invention is applicable also to machines for spinning and doubling, called throstles. *a*, is a conical piece

of wood, of the shape of the nose of the cop. The yarn is wound upon the conical piece in successive layers, as in spinning and doubling machines of the usual construction, when the bottom of the cop has been built by the ordinary copping motion. It will, however, be apparent to any practical spinner, that when the improved conical pieces *a*, are employed, the machinery now required for building the bottoms of the cops may be dispensed with. This machinery in mules, to which the radial arm is applied, consists of all the parts required for varying the position of the nut, to which one end of the winding-on chain is attached. When the conical pieces *a*, are employed, the shaper-plate of the copping motion may be of a plain diagonal form, instead of the irregular form, now required for building the bottom of the cop on to the bare spindle, or on to the cop tubes now known and in use. When the conical pieces *a*, are doffed with the cops, circular grooves are made on their surface, into which the yarn enters when being wound on. These grooves prevent the conical pieces slipping out of the cop when it has been removed from the spindle. When the pieces *a*, are made of paper, the edge of the paper forms a spiral ridge, which answers the same purpose as the circular grooves above referred to. It may sometimes be preferable to fix the conical pieces *a*, to the spindles; when such is the case, a cop tube, made of paper or other material, is used, of the shape of the conical piece *a*, as shown in fig. 2, which cop tube is removed with the cop, and prevents the inner coils of yarn from becoming entangled when the cops are doffed.

Fig. 3, represents one of the conical pieces *a*, with a tube *b*, attached to it of the length of the cop. When the cops with the conical pieces *a*, inside them are taken from the spinning machine to the winding or reeling machines, it is evident that the spindles of the winding or reeling machines must be plain, as now customary, but when the pieces *a*, are fixed to the spindles, and the cops are doffed with the tubes, shown at fig. 2, and then placed on the spindles, these spindles must be furnished with conical pieces similar to *a*, in fig. 1; the same remark is also applicable to the shuttles of looms for weaving.

The hooks *c*, attached to the bottom of the conical pieces *a*, in fig. 4, or to the rings or braids *d*, now used in combination with the ordinary cop tubes, as shown in fig. 4, are for the purpose of overcoming the difficulty now experienced in removing the coils of yarn which are usually wound on the bare spindles below the cop tubes. After a set of cops has been built upon the spindles, but previous to doffing them, the yarn is guided from the top of the spindle to the wire hooks *c*, around which it is coiled a few times; the cops are then doffed, and in removing them each end of yarn is broken; the attendants then place a fresh set of tubes on the conical pieces *a*, (see fig. 1,) or a fresh set of ordinary cop tubes on the braids or rings *d*, as shown in fig. 4; the yarn is then guided from the hooks *c*, around which it has been coiled, as above described, and the operation of building a fresh set of cops proceeds as usual.

The improved mode of banding the spindles of spinning and doubling machines, by means of double-grooved wharves, or of two separate wharves placed near each other, is shown in fig. 1. *e*, is the spindle; *f*, the double-grooved wharve; and *g*, the ordinary horizontal cylinder by which the spindles are driven. The band *h*, passes twice round a portion of the circumference of the cylinder *g*, and enters into both of the grooves in the double-grooved wharve *f*; by this means, a greater surface is ob-

tained for the band when acted on by the cylinder, and in acting on the wharve; consequently a more regular speed is given to the spindle. The length of the band is also greatly increased. It will be apparent, that the same object may be attained by fixing two of the ordinary single-grooved wharves a little distance apart on the same spindle.

The patentee claims, "the form of the nose of the cop, as shown at *a*, in fig. 1, or of the form required for dispensing with the mechanism now applied to spinning and doubling machines for building the bottom of the cop, as hereinbefore described. Secondly,—the application of the conical pieces *a*, to the spindles or skewers of machines for winding, reeling, and weaving, as described. Thirdly,—the improved cop tubes shown in fig. 2. Fourthly,—the application of the hooks *c*, or other equivalent substitutes for facilitating the removal of the yarn hitherto coiled on the spindle, as described in reference to fig 4. And, lastly,—the application of double-grooved wharves, or of two wharves placed near to each other, to the spindles of machines for spinning and doubling, when used in combination with a horizontal cylinder, as shown and described."

To GEORGE LEACH, *of Britannia Mills, Leeds, for an improved mode of, and apparatus for, oiling, preparing, and mixing wool.*—[Dated 14th December, 1859.]

THE object of this invention is to effect the oiling, preparing, and mixing of wool, in a more regular, expeditious, and economical way than heretofore.

In Plate V., fig. 1, is a longitudinal vertical section of one arrangement of machinery for preparing wool for being converted into sliver preparatory to the spinning operation; and fig. 2, is a front elevation of the same. The wool to be operated upon is placed upon the travelling endless feed sheet or apron *a*, *a*, extended over the rollers *b*, *b*, to which a slow motion is communicated from the main shaft of the machine. The wool as it is brought forward by the travelling feed sheet, is carried into the machine by the porcupine roller *c*, which works in a gutter or trough c^*, and has a slow rotary motion communicated to it by means of the spur gearing shown in fig. 2, the spur-wheel c^1, of which is keyed to the axle of the porcupine roller *c*. The wool is taken from this roller *c*, by the teeth or gills of the gill bars *d*, on the large cylinder A, carried by the axle A^1. This cylinder receives rapid rotation in the direction of the arrow from a band *e*, on the main driving-shaft. Behind this cylinder A, is mounted a brush cylinder B, to which rapid rotary motion is communicated from a large pulley *i*, on the axle A^1, by means of a band which passes round a small pulley on the axle of the brush cylinder B, as indicated by the dotted lines in fig. 1. The oil to supply the wool is contained in a cistern C, above the machine, and it is conveyed therefrom by a flexible pipe *h*, to a metal discharge pipe *j*, provided with a cock or tap, and index or register plate, and pointer *k*, whereby the quantity allowed to pass out may be indicated and regulated at pleasure. The pipe *j*, with its cock and register plate *k*, is fixed on a carriage *l*, which is used for distributing the oil on to a fixed plate *q*, whence it is taken up by a rotating brush, and discharged on to the wool entering the machine. The

carriage *l*, is mounted on two horizontal rods *m*, *m*, over which it is traversed by means of an endless leather band or strap *n*. This strap passes round two small pulleys *o*, o^1, and is provided with a pin, stud, or finger, which works in a vertical slot in the back of the carriage *l*, for the purpose of imparting the traverse motion thereto. Rotary motion is communicated to the pulleys *o*, *o*, and consequently to the strap *n*, by means of the cord or band *p*, which passes from a pulley p^*, and drives the pulley o^*, on the axle of the pulley o^1. The oil from the pipe *j*, falls on to the inclined plate *q*, *q*, which is adjustable by means of set screws. As the oil arrives at the edge of the plate *q*, it is discharged therefrom by the rotating brush D, in the form of spray on to the wool spread out on the travelling apron *a*. The brush D, is actuated in the direction of the arrow in fig. 1, by means of a band *r*, driven by a small pulley *s*, on the axle of the brush cylinder B.

Fig. 3, is a longitudinal section of another arrangement of mechanism for carrying out the operation of oiling, preparing, and mixing wool.

In this arrangement, for the purpose of mixing water with the oil, the patentee connects two vessels *a*, *a*, by flexible pipes, with a forked discharge pipe *b*, in which the oil from one vessel, and water from the other, run together. This pipe *b*, is attached to a slide or carriage *c*, which receives a traverse motion from a double-action endless screw-shaft *d*, to which continuous rotary motion is communicated by means of belts and pulleys, from the axle of the gill cylinder A. Immediately below the discharge pipe (as in the before-described arrangement), a rotary brush *e*, is mounted. In this instance, however, the oil (mingled with water) falls directly on to the brush, the bristles of which, striking as they rotate against an adjustable fixed ledge or bar *f*, will throw down the liquid on to the wool below. To facilitate this operation, two feed sheets *g*, *g*, are employed, placed one above the other, to deliver the wool to the gill cylinder. This arrangement will not only more effectually oil the wool, by the wool being turned over in falling from the top to the bottom feed sheet, and, consequently, receiving the oil on both sides of the feed, but it admits of wool of different colors being delivered to the gills simultaneously, which, for "mixtures," is very convenient. The operation of this machine is similar to that above described, that is, the oil is supplied to the wool in the form of a shower or spray by means of the rotating brush or its equivalent, which is supplied continuously from a fountain or elevated cistern, through a flexible supply pipe, the mouth or open end of which is made to traverse to and fro, from side to side, of the machine. The shower or spray will be delivered on to the wool, as it moves forward to the gill cylinder, by the travelling endless aprons. For regulating the discharge of oil and water to the requirements of the wool submitted to the action of the machine, the supply may be adjusted by means of the taps in their respective supply pipes, and for greater convenience, the supply taps may be fitted with a pointer or index, mounted in front of a graduated dial or plate, indicating the quantity of liquid which will pass through the tap when opened to a given extent. By this means, the number of pounds or pints of softening liquid per minute or hour, which it is desirable to supply to a certain quantity or weight of wool, may be regulated at discretion and with accuracy. As the oiled fibres are carried round by the gill cylinder, they are brought into contact with the rapidly rotating brush B, which strips the wool from the gill pins, and discharges it in an

opened state into a suitable receptacle, or on to a travelling apron, which will convey the same away from the machine.

The patentee claims, "effecting the equable distribution of oil or oleaginous substances to wool, preparatory to its being prepared for spinning, by the means above described."

To HENRY BAYLEY, *of Stalybridge, Lancashire, for improvements in the construction and manufacture of cop tubes used in machinery for spinning fibrous materials.*—[Dated 20th December, 1859.]

HITHERTO cop tubes have been made of metal, wood, paper, woven fabrics, and compounds of gutta-percha and india-rubber, but all tubes hitherto made have been faulty and objectionable. Those made of metal have not had sufficient adhesion upon the yarn, and the form in which they have been made is objectionable, and if made of the form most suitable they are too heavy. The objection to tubes of wood is, that they split at the "nose" or small end, and the objection to tubes of paper, gutta-percha, and other similar materials, is, that they break or become imperfect at the "nose" or small end, so as to render them useless in a short time.

Now this invention consists in constructing a cop tube of two or more materials, the bush or core being formed of thin metal extending the whole length of the tube, and covered with paper, woven fabric, or gutta-percha and its compounds. In some cases the metallic core or bush need only extend a short distance from the nose or small end of the tube, so that it be firmly secured in its place by the external covering materials.

In Plate VI., fig. 1, shows a section of a tube made with a thin brass core covered with paper, &c.; fig. 2, is a side view of another tube, made with a metallic bush or core *a*, which is not solid, being formed of sheet metal of the shape shown by fig. 3, bent into cylindrical form, so that the two edges a^1, and a^2, abut against each other, as shown in side view at fig. 3, the bottom end of the bush or core having a strengthening ring a^3, which is formed by turning up the edge of the sheet. This bush or core is similar to the tube known as the "American tube," but the sheet metal from which it is made should be roughened on that side which is to form the exterior of the bush or core, so as to give hold for the covering material. Another way of constructing a bush or core is shown by figs. 4 and 5. Fig. 4, shows the shape of the strips of sheet metal employed, which are made rough on the outside, and fig. 5, a side view of the bush *a*, when formed. The strips are formed into bushes by being wound round a mandril of the proper size, the parts a^4, at each end overlapping the edge of the strips, as seen in fig. 5. The strips of paper or calico employed for covering the bushes are of similar shape to such as are used for making tubes wholly of paper or calico; and the machine for winding the paper or calico upon the bush, and applying the paste or cement, is the same as those employed for making paper or calico tubes wholly from strips of paper or calico; the bush being first placed upon the mandril of the machine, and the paper or calico being wound upon the bush. Further, to secure the bush (when solid, or when similar to those shown by fig. 3,) each end (or that end which is without a ring a^3, or flange) should be slightly expanded or rivetted over the end of the paper or calico, taking

care there is no sharp edge or projection left at the small or nose end of the tube which would catch or obstruct the unwinding of the yarn or thread from the tube. The turning over the ends of the bush of each tube may be effected as shown at fig. 6, where *b*, is a metal block, with a hole in it made to fit the tube, which is placed in the hole, when a punch *c*, is brought against the large end of the tube, and another, *d*, against the small end, with force sufficient to slightly expand the ends of the bush *a*; both punches are then lifted,—the punch *d*, lifting sufficiently to push the tube from the hole in the block *b*, and the punch *c*, a little more, to give room to take away the tube delivered, and replace it with another requiring to be expanded; both punches then descend till the tube is in the proper place in the hole in the block *b*, when the punch *d*, will make an ascent, and the punch *c*, a further descent to the extent required for expanding the ends of the bush. These movements may be made by two double-action cams, one for each punch. Arrangements similar to those last described may be used for inserting cores into tubes first made in the ordinary manner, but it is preferred to make the tubes by winding or moulding the covering material round the bush when the material is of such a nature as can be treated in this manner. Fig. 7, is a side view of a tube having a bush a little way from the nose or small end, but the bush should be passed entirely through the tube as in fig. 1.

The patentee claims, "the construction of compound cop tubes formed of two or more materials, namely, a strong and tough material forming an internal core or bush, which is covered with other materials of small specific gravity, as described; also the use of cop tubes so constructed; and likewise the modes of making such tubes, as described."

To George Bedson, *of Manchester, for improvements in puddling furnaces.*—[Dated 14th December, 1859.]

This invention consists in forming the bottoms and sides of puddling furnaces hollow and of wrought iron, constituting chambers, into and out of which a stream of water is allowed to flow.

The figure in Plate V., represents, in longitudina lsection, a puddling furnace constructed according to these improvements. The furnace bottom is shown at *a*, formed of wrought-iron plates, the sides *b*, being constructed after the same manner, so that a water chamber surrounds the iron while it is being puddled. At *c*, is a pipe, by which water is supplied; and at *d*, another pipe, by which it is allowed to flow out. The latter is shown as carried upwards, and the escape takes place from the upper end; the feed-pipe, therefore, must contain an equal or superior column, so that the water chamber may always be full, and the rapidity of the current may be regulated by a stop-cock at *e*, or other convenient situation.

The parts constituting the furnace bottom and sides may be put together by angle iron and rivets, or by other ordinary means, or the whole may be welded, so as to avoid the use of joints.

The patentee claims, "forming the bottom and the sides of puddling furnaces of wrought-iron water chambers."

To FREDERIC YATES, *of Parliament-street, Westminster, for improved apparatus for generating certain gases to be used as fuel, and as reducing agents in metallurgic and other operations, and improvements in furnaces to be heated and worked therewith.*—[Dated 25th January, 1860.]

THIS invention relates, firstly, to the production of certain gases by the action of atmospheric air on incandescent carbonaceous matter—the latter in excess; and also to improved apparatus, whereby these gases are applied as fuel and reducing agents where high temperatures are required, such as in puddling, welding, smelting, or otherwise treating iron or iron ores; also, in making or melting steel, in reducing or operating with or upon other ores or metals. This part of the invention is also applicable in glass making, evaporating water, generating steam, or for other similar processes.

The second part of the invention relates to improvements in the construction or arrangement of apparatus and furnaces, in which are placed materials to be acted upon by the gaseous matters produced as above.

In Plate V., fig. 1, is a vertical section of one of the improved gas generators; fig. 2, is a similar view of a modification of the above; and fig. 3, is a sectional view of another form of gas generator. Fig. 4, is a vertical section of a reverberatory furnace to be used for melting steel, having the improved gas generators adapted thereto, one on each side of the furnace; and fig. 5, is a vertical section of a puddling furnace, with one of the improved gas generators adapted thereto.

Instead of causing the air of ignition to pass into the carbonaceous matter only, at or about the lower end of the decomposing chamber, and to flow in an upward current through the chamber, the decomposing chamber is arranged in the manner shown in figs. 1, and 2, whereby many advantages are gained, such as the thorough conversion of the product of distillation into gases, and these again coming into the chamber of ignition in the hottest possible state. The air is admitted into the closed decomposing chamber A, A, by one or more tuyeres *a*, *a*, thereby producing a downward current, as shown by the arrows. But when a compound generator is used, as shown at fig. 2, the air is admitted not only at the top through the tuyere *a*, but also at or about the bottom through one or more tuyeres *b*, *b*, thereby forcing it, partly in an upward and partly in a downward direction, through the incandescent matter. If hot air is used in the decomposing chamber (which, with certain carbonaceous matters, such as anthracite, is preferable), a common water tuyere is employed.

The decomposing chambers or generators A, are made of any shape, and from three to thirteen feet in height or length (according to the carbonaceous matter to be employed), and of refractory materials, cased with massive brickwork or cast or wrought-iron plates. These generators are set, by preference, in a perpendicular position, and at each end of the long axis of the furnace, as shown at fig. 4. The generators may be placed above the level of the fire-bridge, as shown at fig. 1, or, for practical convenience, they may be placed, as shown at fig. 4, where the bottom of the generator is sunk somewhat below the level of the fire-bridge, without altering the principle of the downward current of the air or gases. The air is forced into the incandescent mass of fuel through one

or more tuyeres, as shown at *a*, *a*, at fig. 1, at or about the upper end of the generator, or that part furthest from the fire-bridge, and below the charge of fresh fuel, so that the air passes in a current downwards through the incandescent carbonaceous matter, thereby converting all the fuel and the tars and oils distilled out of the carbonaceous matter into the gases required, such as carbonic oxide and carburetted hydrogen.

In certain cases, the generators are placed partly below the level of the fire-bridge, as shown at fig. 2, and the air is forced in at the top and bottom of the generator through the tuyeres *a*, and *b*.

It will be seen that, in the gas generator above described, a distinctive feature in its construction is, that no fire-bars are employed; in fig. 3, however, a generator is employed, in which fire-bars are used. The generating chamber is supplied with carbonaceous matter, from two to three feet in depth, which rests upon the fire-bars *a**, and in order to diminish and regulate the supply of air to the carbonaceous matter, a conical chamber *b**, is adapted to the under side of the fire-bars, and provided with a throttle-valve *c**, or other equivalent contrivance, so as to give the attendant perfect control over the supply of air. Another valve *e**, is adapted to an opening at the bottom of the ash-pit, and may also be made to serve as a regulator for the admission of air. *d**, is the clearing-out hole at the bottom of the generator. For supplying the air of ignition, a blast of a certain pressure is used, and the air is forced into the incandescent mass of fuel by means of a fanner or blast cylinder, according to the fuel employed, but sometimes the draught from a common chimney alone will suffice. For the generation of the gases, cold air is preferred; but for certain sorts of fuel, such as anthracite, the air should be heated. The air-pipes for the admission of the air of ignition, if artificial blast be used, are supplied with stop-cocks *c*, to enable the workman to control the quantity of air going in at the tuyeres, as upon the proper regulation of the supply of air, in a great measure, the success of the operations depend. Holes are left in convenient parts of the generator, as at *d*, figs. 1, 2, and 4, for clearing away the cinder or ashes which accumulate. The decomposing chamber should be kept air-tight whilst the operation of filling it with the carbonaceous matter is taking place. This object may be effected in various ways, and two simple arrangements for the purpose are shown at figs. 4, and 5. At fig. 5, *e*, is a cast-iron hopper, capable of containing from one to two, or more, cubic feet of carbonaceous matter; *f*, is a cover, fitting air-tight into the rim of the hopper; the rim being made in such a manner that it can be filled with sand or other like substance; *g*, is a cone or stopper of fire-brick or cast-iron, fitting air-tight into the under side of the hopper; *h*, *h*, are rods, fastened on to the stopper *g*, at one end, and to the lever *i*, at the other; *j*, is a chain, fastened to two light rods *k*, *k*, attached to the cover *f*, at the one end, and running over two pulleys *m*, *m*, to a counterweight *l*, at the other. This apparatus is placed directly over the centre and top of the generator A; and on the counterweight *l*, being pulled, the cover *f*, rises sufficiently high to allow of the fuel being thrown into the hopper *e*: when this is done, the cover *f*, is allowed to fall, and close the hopper quite air-tight. When it is desired to fill the generator, the lever *i*, is raised, and the stopper *g*, is lowered, thereby allowing the fuel to fall into the generator. The counterweight at the end of the lever *i*, brings the cone or stopper *g*, back again

to its seat: the hopper being again filled, the same operation can be repeated.

At fig. 4, *e*, is the hopper of the filling apparatus, with an air-tight cover *f*, as in the former instance, and *g*, is a slide, made of iron or fire-clay, upon which the fuel rests. Upon this slide being withdrawn, the fuel falls into the decomposing chamber A.

When working the furnace, the generator is supplied with a small quantity of carbonaceous matter, which is ignited through the holes *d*, and then the chamber A, is gradually filled through the hopper *e*, until the ignited fuel reaches above the tuyeres *a*; the holes *d*, are then to be closed up, and a small quantity of air is to be let in through the tuyeres *a*, when the gases begin to be generated. The filling operation must then be continued at regular intervals, or as the carbonaceous matter is consumed. The gases, so generated, are conducted through the passage B, fig. 4, into the furnace or chamber C, where they will be burned, by the addition of a certain quantity of air which is caused to intermingle with the gases, and in this case is made to produce a neutral flame, which is the only flame that can be advantageously used for melting steel in the furnace, shown in fig. 4. This furnace is intended for heating or melting steel, or alloys of iron and carbon, for which purpose the substance to be operated upon is placed upon the sole or hearth of the furnace, in pieces of convenient size, and the neutral flame is made to act upon it and heat or melt the same.

In order to bring about the proper combustion, or any special condition of the gases, formed as above, so as to produce a high degree of heat, such as will be required to melt steel or other alloys of iron and carbon, a tuyere *n*, fig. 4, for the admission of hot air to promote the combustion of the gases, is placed outside and at the back of the passage B, leading from the generator, and pointing through the middle of the opening above the fire-bridge to about the centre of the furnace or chamber C. This tuyere, for certain purposes, is placed in various positions (as, for instance, in figs. 1, and 2,) in advance of the fire-bridge above the arch, and pointing perpendicularly downwards, or in a slanting direction upon the materials or parts of the furnace or apparatus to be heated.

An improved arrangement of tuyere is shown in section at fig. 10, which will throw a thin sheet of air, at any desired angle, into or upon the current of gaseous matter, and thence upon any part of the furnace or materials to be heated. The tuyeres, shown in cross section at fig. 7, and in longitudinal section at fig. 8, are so constructed, that they will not only throw a thin sheet of air, but this sheet may also be divided into several parts, so as to project the current at different angles from the main direction of the tuyere itself. This object is effected by affixing to the main hot-air pipe *o*, figs. 4, and 5, instead of the undivided tuyere in fig. 6, which projects the air in a thin sheet, a compound tuyere, so arranged, that the sheet of air is divided into two or more parts, and each or every part is capable of being fixed at different angles to the main direction of the body of the tuyere, so that it can, at pleasure, be pointed in any desired direction upon the gaseous current or points to be heated.

The undivided tuyere (shown in fig. 6,) is made of thin sheet iron, of a pear-shaped section, and from two to three feet in length, according to circumstances. *o*, is the branch to join it to the main hot-air pipe; *p*, *p*,

are bars of iron, of considerable thickness, and from three to four inches broad, running along the whole length of the nose or slit, to protect the sheet iron from being burnt away; they are fastened to the sheet iron body of the tuyere by rivets or screws, to facilitate their removal for renewal when burnt.

The divided tuyere, shown at figs. 7, and 8, is a compound tuyere for throwing a divided sheet of air, but can also be made to throw an undivided sheet, and is made chiefly of cast iron. A series of cylindrical boxes *q*, *q*, are turned at their end, so as to fit air-tight, one into the other, and are kept in their places by means of a long rod or screw-bolt *r*, *r*. On these cylindrical boxes *q*, *q*, nozzles are cast, into which nose-pipes *s*, *s*, made of gas tubing, are fitted. *o*, is the branch, whereby the divided tuyere is connected to the main hot-air pipe and the nose-pipes *s*, *s*, and are flattened at their extreme end, and protected from burning by means of thick rings *t*, *t*, as shown. By slackening the screw-bolt *r*, the seven cylindrical boxes *q*, *q*, are loosened in these sockets, thus rendering it easy to place them at any desired angle and point one or more tuyeres in any desired direction, as shown by dotted lines at *u*, *u*, fig. 7. The main hot-air pipe is supplied with a stop-cock, to regulate exactly the amount of air to be admitted through this tuyere.

The arrangement preferred for heating the air of combustion is shown in fig. 4. The air should be hot, and in order to obtain the requisite degree of temperature, the air is passed through cast-iron pipes *w*, *w*, placed in the chimney or flue of the furnace. The waste heat of the furnace itself is used to heat these pipes.

Fig. 4, represents a section of a furnace for melting steel or other metals, welding large masses of iron, or for other purposes where intense heats are required, for which purpose two generators are adapted. *c*, is the body of the furnace, which is of an elliptical section; D, is a moveable arch, composed of graphite, coke dust, charcoal, or the like, mixed with fire-clay, and stamped very solid in an almost dry state into a framing of wrought iron, which rests upon the solid masonry of the side walls of the body of the furnace. By thus making the dome or arch of the furnace removeable with facility, a fresh arch can be put on to the furnace, when required, without materially interfering with the operation of the furnace. The bottom of the furnace is dish-shaped, and is rammed in quite solid, and composed of the same materials as the arch. The bottom *x*, is composed of fire-bricks; *y*, is the plate, upon which the bottom rests; and *y**, are plates for keeping the furnace together at the sides: a tap-hole is provided for running off the molten metal, and an exit aperture for the products of combustion. A, A, are the decomposing chambers; B, B, are flues, through which the gases pass to the furnace *c*; *n*, *n*, are the tuyeres of combustion; *e*, is a feeding hopper, with air-tight covers *f*, as before described; and *g*, a slide of fire-clay, for allowing the fuel to descend into the generating chambers A, A. *d*, *d*, are holes for clearing away cinder or ashes; and *a*, *a*, *a*, are the tuyeres of ignition. It will be evident that, if desired, the furnace *c*, as well as the dome, may be so constructed as to be as easily removeable as the dome or arch itself. To this end, the hearth or walls of the furnace, together with the dome or arch, are constructed in one piece, so as to form a kind of barrel-shaped crucible, which is capable of being removed. A moveable furnace of this kind is formed, by preference, of iron; or may consist of a frame or

case of baked fire-clay. This case is to be filled with graphite or carbon, mixed with fire-clay or other refractory material, and well rammed in. The moveable furnace must, of course, have suitable apertures made in it for the admission of the heated gases and the exit of the gaseous products of combustion, and is to be mounted upon rails, so that it may be moved into or away from its place when required.

The patentee claims, "First,—the mode of, and apparatus herein set forth for, generating the combustible gases. Second,—the mode herein set forth of supplying atmospheric air to the heated gases. Third,—the improved construction of tuyeres shown and described. Fourth,—the mode herein set forth of melting cast steel or alloys of iron and carbon; also, the arrangement or construction of furnaces, herein shown and described, for heating metals or forgings, or melting metals or alloys, or for other purposes, particularly where a high degree of heat is required; and also the mode of constructing the hearth or sole and the dome or arch of reverberatory furnaces. Fifth,—so constructing the body or that part of the furnace wherein the materials to be operated upon are placed, that it, or part thereof, may be removed when required, as above set forth. Sixth,—the mode herein shown and described of constructing and heating puddling, reheating, or reverberatory furnaces."

To SAMUEL ROWBOTHAM, *of Putney, and* THOMAS GRATTON, *of Derby, for a composition for rendering uninflammable linen, cotton, silk, or other inflammable fabrics and substances.*—[Dated 2nd January, 1860.]

THIS invention consists in the application of a composition formed of certain chemical products to fabrics and substances, for the purpose of rendering the same uninflammable.

To produce a composition applicable to the purpose of rendering fabrics and substances uninflammable, the patentees use bi-borate or borate of soda, or of potash, magnesia, or other base, which is to be mixed with the mucilage or jelly of quince, marsh-mallow, linseed, tapioca, dextrine, or gum of any kind, or of any animal or vegetable substance; to this may be added, as required, a portion of carbonate of soda, potash, or magnesia (according to the base used), which tends to neutralize any excess of boracic acid, and thereby destroy corrosive quality and render the whole mass more easily combinable. This is thoroughly incorporated with starch, and well dried and ground, when it may be used as starch is ordinarily used, which will have the effect of rendering the fabrics uninflammable; or it may be used as a varnish to coat paper and other inflammable substances; and to render it suitable as a rinsing or dipping fluid, it may be used in a diluted state; or the boracic acid compounds may be used for this purpose, without admixture with the starch or mucilage.

The patentees claim, "the rendering of fabrics and substances uninflammable in the manner described."

To John Chatterton, *of Highbury-terrace, and* Willoughby Smith, *of Pownall-road, Dalston, for improvements in treating gutta-percha, india-rubber, and compounds of those substances.*—[Dated 14th January, 1860.]

One object of this invention is to render gutta-percha, india-rubber, and compounds containing either of those substances, when employed for coating and insulating electric telegraph conductors less permeable when subjected to great pressure of water, and also more durable when exposed to air. Another object is to improve the pliability and durability of tubes and other articles made of gutta-percha, india-rubber, or compounds containing either of such substances.

The invention consists in immersing and soaking, for some hours, such coated or insulated electric telegraph conductors, tubes, and other articles in a heated insulating liquid, not being a solvent of gutta-percha or india-rubber, which will fill the pores of such substances. To this end, a tank is used, having a space or jacket around it, for heating its contents either by steam or hot water; the tank is then about three-parts filled with Stockholm tar, heated to between 80° and 90° Fahr.; coils of insulated wire are then suspended in the liquid, and allowed to remain immersed from ten to twelve hours; they are then taken out, and each wire is passed through a die or suitable stuffing-box, to take off the superfluous liquid. When the coated wire is required to be made into a submarine cable, the covered wire is subjected to this process immediately before it is covered with tarred yarn, as the tarred yarn will then adhere more effectually to the coated wire than when the coated wire is taken out of the water tank, and, in a wet state, covered with the tarred yarn, as is now generally done. In some cases, about one-fourth of its weight of clean resin is added to the tar, which renders the mixture stiffer or harder when cold. In like manner, bands, tubes, and other articles made of gutta-percha, india-rubber, and compounds of those substances, are soaked in tar, or a mixture of tar and resin, or other similar liquid, not being a solvent, in order to improve their pliability and durability; the liquid adhering to them, when they are taken out of the vessel, being removed by passing them through a die.

To Francis Gybbon Spilsbury, *of Bow, for a certain translucent or transparent fabric, and for certain applications of the same to various purposes.*—[Dated 24th December, 1859.]

To make a translucent material, the patentee selects those fabrics or natural products which are most translucent in themselves, such as the finest tissue paper, muslin, skin, or perforated cardboard. A sheet of either of these he dips into a solution of silicate of soda or potash, usually called "soluble glass," either by itself or mixed with phosphate, borate, or tungstate of soda or potash. The sheet, when pressed and dried, is complete, and is the simplest form of the invention. To render the fabrics as translucent in themselves as possible, they may undergo a previous preparation before the soluble glass is applied; and sometimes, for ornament or strength, two fabrics may be joined together. For example, a sheet of fine tissue paper may be oiled, or dipped into a strong solution of fat or resin soap, or into a solution of resinous matter in spirit, or other liquid

capable of dissolving it; when dry, the paper, thus prepared, is dipped into soluble glass, and exposed to the air until the superfluous moisture is evaporated, after which it is passed between rollers or under other mechanical pressure, and, when dry, it is ready for any use it may be applicable to. To impart greater strength to the paper, previous to coating it with the soluble glass, a piece of fine net or muslin is laid over it, and the soluble glass is passed over both with a brush, after which, being subjected to pressure, the two tissues become incorporated into one. In like manner, by way of ornament, paper stamped and pierced in patterns may be backed with the prepared tissue paper, and the two surfaces incorporated by pressure and the solution of the soluble glass.

The transparent medium, thus produced, may be converted into small boxes or cases, to be filled with tallow or other material, in the same manner as what are called "Childs' night-lights," and thus shadowless night-lights may be obtained; or it may be made into shades, to be fitted on candles or other lights, to enable them to be carried about with the same facility as in a lantern; or used as a substitute for wire blinds for windows; or as the ordinary tracing paper used by artists and engineers.

To WILLIAM EDWARD NEWTON, *of the Office for Patents,* 66 *Chancery-lane, for improvements in piston packing,—being a communication.*—[Dated 3rd February, 1860.]

THIS invention consists in producing the expansion of the packing ring or rings of pistons, to make them fit the cylinder in which they work, by means of two levers, which are fitted to the central hub or boss of the piston head, and are made to act on a cut metal ring fitted to the interior of the packing ring or rings.

The figure in Plate VI., shows the head of the piston with a central boss or hub B, cast on it. R, is the piston-rod; C, is the follower-plate, secured to the head by means of screw-bolts *a, a,* in the usual manner; D, D, are the packing rings, cut open obliquely at one point, in the usual manner, as shown at *b,* to permit of their being expanded. E, is the inner ring, of a depth equal to that of the two packing rings, and fitted to the interior of those rings. This ring has an opening *c,* on one side; the sides of the said opening being parallel with the axis of the ring, but levelled from the interior toward the exterior in opposite directions. In the ring E, two pins *d,* are secured, to enter the cuts *b,* in the packing rings. F, F^1, are levers curved to fit against opposite sides of the hub or boss B, which serves for their fulcrum: these levers are so arranged, that their arms g, g^1, enter the opening *c*; and one of the arms lies against one side, and the other against the opposite side of the opening *c.* The arm f^1, of the lever F^1, rests against one of the sockets a^1, a^1, that are provided on the piston head for the bolts *a, a,* to pass through; and the arms f^1, of the lever F^1, rests against the cam G: this cam is fast on a short shaft *h,* which works in one bearing in the piston, and in another in the follower; and the end of this shaft, which enters the follower, is made with a square end, to receive a wrench, by which to turn it, to bring the cam into operation on the lever F, for the purpose of expanding the ring E. The shaft *h,* has secured upon it a ratchet-wheel H; and a pawl *i,* attached to the inside of the follower C, is pressed against the ratchet-wheel by a spring *j,* to prevent the

cam from turning in the opposite direction to that in which it is required to turn to bring the lever into operation to expand the ring E, and to arrest the cam in the position to which it may be adjusted.

The packing rings are adjusted or set out in the following manner:—The piston is placed within the cylinder before the rings are expanded, in which condition it fits the cylinder loosely, and after it has been properly connected with the engine, the cam G, is turned, by applying a wrench to the square of its shaft, in such a manner as to make it press the arm *f*, of the lever F, toward the arm f^1, of the lever F^1, and by that means the arm *g*, of the lever F, is made to press upon its side of the opening *c*, of the ring E. This pressure has a tendency to turn the ring, but is counteracted by the pressure of the arm g^1, of the lever F^1, against the opposite side of the gap, and hence the two levers are made to press upon the ring in opposite directions, and to expand it circumferentially against the packing rings D, D, and to force the rings outward against all sides of the cylinder. When the packing rings have worn so as to require expanding or setting out, a slight turn of the cam will be sufficient to make it tight again, and as the expansion is equal all round, the cylinder will always wear circular, and never require re-boring. The levers should be made of steel, so as to possess some elasticity. The ends of the arms *g*, *g*, are bent to hook over the bevilled sides of the cut *c*, of the ring E, and the cut at the top of the said ring. By this means, the piston head is kept suspended from the rings, and the piston rod is kept in line with the cylinder.

The patentee claims, the mode herein set forth of constructing the elastic metallic packing of pistons, particularly the combination of the levers F, F^1, acted upon by a cam, or its equivalent, so as to press the levers apart, and cause them to act on the split or cut ring which forces out the packing rings; also shutting or enclosing the cam G, or its equivalent, in the piston.

To EDWARD JAMES HARLAND, *of Belfast, for improvements in constructing and covering the decks of ships and other floating bodies.*—[Dated 6th January, 1860.]

THIS invention consists in the construction of the decks of ships or other floating bodies of iron plates, either corrugated or formed with projections on, or cavities in, the surface of the same, of any desirable pattern, which projections are made higher and cavities deeper than in the plates which have hitherto been in use for foot-plates in engine-rooms. The cavities in these plates and spaces are filled in with Portland cement, Roman cement, or other cement, sand, and sulphur, asphalte, marine cement, or any other suitable material or combination of materials. The patentee also covers decks formed of iron plates, either plain, corrugated, or made with projections and cavities as above described, or decks of any other material, with a suitable layer of stone, stoneware, earthenware, gravel, tiles, bricks, or any modification of the foregoing, metal borings, wood paving blocks, or any other material that can be adapted to the purpose, which material he proposes to unite and hold together, and to the iron decks beneath, by means of asphalte, vegetable or mineral pitch, rosin, or other bituminous substance, pigments, sulphur, and sand,

Roman, Portland, or other cement, or any substance capable of uniting or binding the aforesaid stone, stoneware, or other materials to each other, and to the iron decks.

Where it is necessary to pass spindles, bolts, pumps, or other metal or woodwork through the iron deck, or secure cleats, winches, or other fittings thereto, the patentee fastens a suitable block or socket of metal or wood to the deck for that purpose, level with the surface of the covering material, and passes the spindles, bolts, pumps, or other metal or woodwork through the same, or fastens the cleats, winches, or other fittings to the same in the usual way, as the case may be.

The patentee claims, "the decking over of ships or other such floating bodies with wrought-iron plates, either corrugated or rolled, and impressed with a ribbed pattern on the surface of the same, so as to suit the regular spacing of rivets or bolts; attaching the same to the adjoining plates and to the beams, and then filling up of such cavities formed by this pattern with any one of the previously named substances, or with a combination thereof, so as to give a smooth and even surface to such chequered or corrugated iron deck." He also claims, "the covering over of such iron decks, or those formed of plain or chequered iron plates, or of wood, in the ordinary manner with pavement, as described."

To ALEXANDER MEADOWS RENDEL, *of Great George-street, for improvements in the construction and arrangement of ships of war.*—[Dated 16th January, 1860.]

THIS invention consists in employing armour, in the form of iron or steel plates backed with timber, or otherwise protected in-board of the ship, upon longitudinal and transverse bulk-heads or girders extending upwards from the ship's bottom, or other convenient place, to the height requisite for the shelter of the gun-deck, with or without plating of any thickness, laid upon timber or otherwise protected and strengthened overhead. The armour necessary for the protection of the ship may be placed wholly on the girders, or only so much as is necessary for the protection of the gun-deck and deck below; it may be placed on the girders, the remainder being placed on the ship's sides, or otherwise connected together.

In arranging ships of war, whether the armour, as above described, be applied, either in whole or in part, the patentee places the weight of the armour as near the centre of gravity of the ship as possible, with a view to diminish the oscillations it would occasion. For the same purpose, and also to increase the steadiness of the platform from which they are fired, he places the guns as near the centre of the ship as possible. To facilitate the working of the ship, he constructs a gangway all round the battery between the ship's sides and the space enclosed for the battery; and the ship itself he constructs in such a manner as to incorporate some of the material necessary for the protection of the battery into the strength of the ship, and thus saves the ship's sides from the straining which would result from the armour being laid upon them; and in combination with wrought-iron upper and lower decks, he divides the ship into a great number of water-tight compartments.

The patentee claims, "the construction and arrangement of ships of war, as described."

To Willoughby Smith, *of Pownall-road, Dalston, for improvements in transferring designs, and in ornamenting glass and other surfaces; also in the manufacture of slides for magic lanterns.*—[Dated 14th January, 1860.]

In transferring designs according to this invention, the patentee takes a print, either colored or otherwise, or a design otherwise produced on paper or other similar material, and coats the surface thereof with collodion; when the collodion is set and hard, the paper on which the design was originally produced is washed off, and the ink or color will then be found firmly attached to the film of collodion. The design to be transferred is first stretched upon a board, and then coated over by means of a brush, one or more times with collodion, of about the consistency of cream. When the collodion is perfectly set and hard, the print or drawing thus prepared is put into water, to soften the paper, and, when thoroughly soaked, the paper is easily removed by rubbing, leaving a thin transparent film of collodion with the design firmly fixed upon it; the film of collodion is then allowed to dry, and, when dry, the side of the film from which the paper was removed is coated with thin collodion, Canada balsam, oil, or with transparent varnish. In some cases, in order to render the film of collodion more tough, about three per cent. of castor oil is mixed with the collodion, by boiling them together till both are thoroughly incorporated, and when a greater transparency is required, there is to be added about three per cent. of Canada balsam to the collodion, by the same process of boiling as before mentioned; the film of collodion, with the design upon it, is then ready for mounting upon the surface to be ornamented. When it is to be employed for ornamenting glass, it may either be mounted on a sheet of glass, by pasting paper around the edges of the glass, and attaching the edges of the film of collodion by cement or varnish to the paper, or it may be placed between two sheets of glass, the edges of which are then secured by pasting a strip of paper around them; the film of collodion may also be mounted in a frame or stretcher by attaching the edges of the film to the frame or stretcher. When the film of collodion is to be employed as a slide for a magic lantern, it may either be mounted on one sheet of glass or between two sheets, or it may be mounted in a frame, as above described.

To Joseph Goddard, *of Stockport, for improvements in the preparation and dyeing of yarns or threads.*—[Dated 13th January, 1860.]

This invention relates principally to the preparation of such yarns as are known as "doubled yarns" to be dyed black, whereby they are enabled to take increased lustre during the subsequent process of polishing or finishing.

The improvements consist, first, in boiling the yarns (generally in the hank) in plain water, after which they are steeped in a solution of catechu (also commonly known as "cutch," "scutch," or "gambia,") and sulphate of copper, mixed in suitable proportions, for about eight hours or more; they are then to be passed through lime water, and afterwards through a solution of sulphate of iron, then through lime water again, and next through a decoction of logwood and fustic, to which is added a solution

of sulphate of iron. After the yarns have passed through it, they are passed through the mixture of logwood, fustic, and sulphate of iron; they are now passed through lime water again, and thorugh a solution of logwood and fustic, and through the mixture as before, and finally through a solution of soap and water, and dried, and, if required, polished and finished as usual.

By thus treating the yarns with the solution of catechu and sulphate of copper, before dyeing, they are rendered capable of receiving a better lustre in polishing, and of retaining the dye better and more permanently, and have an improved color and general appearance. The proportions of the ingredients forming the first solution are, for every twenty pounds of yarn, of gambia or catechu about twelve pounds, sulphate of copper two pounds, and twenty pounds of water, the proportions of the dyeing liquor being about the same as usual.

The patentee claims, "the preparing and dyeing of such yarns as are known as doubled yarns, or other descriptions of yarns requiring to be dyed black by the aforesaid means."

To Richard Archibald Brooman, *of Fleet-street, for improvements in extracting substances from cereal grains and some of their products, and the application of the substances extracted,—being a communication.*—[Dated 17th January, 1860.]

In cereal grains, such as wheat, and in some of the products therefrom, such as the residuum left in the manufacture of starch, gluten, bran, flour, and certain sorts of starch, soluble substances are found in various forms which are capable of precipitation. These substances have great analogy with gluten hitherto produced by the aid of alcohol, that is to say, with a substance which is called in France glutine, and which is produced by repeatedly washing farinaceous matter with hot alcohol, extracting the vegetable caseine, concentrating the same, and treating it with water.

The component parts of cereals are generally the outside skin or husk, the starch, the glutine, the internal fibrine or germ. Now, by the aid of powerful agents, and in a highly-concentrated state, these four substances are capable of being dissolved, but with more or less injury to them. By the employment of weak agents, which do not require to be concentrated, the inventor dissolves the glutine only. The skin of the wheat is easily separated from the other parts by filtration, sifting, or otherwise. On being left to settle, the starch, with a part of the vegetable fibrine, becomes deposited, when, by drawing off the supernatant liquor, the glutine is obtained in solution, with the vegetable fibrine floating in it. If the liquid is now allowed to remain some time at rest, the whole of the fibrine becomes deposited. The separation may, however, be effected quicker by the employment of a centrifugal filtering machine. There is, however, another mode of effecting the separation. By precipitating the glutine from the solution, it carries down all the vegetable fibrine, and a precipitate is obtained very analogous to gluten. As it is not necessary to precipitate the whole of the glutine to carry down all the fibrine, that quantity of glutine only is precipitated which will leave a liquid more or less transparent, according as it is desired to produce from it glutine more or less free from vegetable fibrine. A deposit is thus formed of a

mixture of glutine and vegetable fibrine, with a liquid composed chiefly of glutine in solution; from this the glutine is precipitated, and then well washed with water or other suitable liquid.

Instead of obtaining first a precipitate of impure glutine, and next a precipitate of pure glutine, the precipitates can be made at one operation; or, instead of precipitating twice, the operation may be extended to three or more precipitations; care being taken to separate each precipitate. When flour or gluten is operated on, bran is held in suspension in the solution, from which it may be separated by sifting, by allowing the solution to rest, or otherwise. The starch and vegetable fibres are separated in the manner described, with reference to the treatment of wheat. Starch waters containing glutine in solution are treated as a solution of glutine.

The solutions may be made, first, of acid waters resulting from the washing of starch; second, of most organic acids; third, of most mineral acids; fourth, of most of the soluble oxides; fifth, of most kinds of salts. The solution is made by submitting to the action of one of the above agents the substances which contain glutine. The precipitation of the glutine is effected by the neutralization of the solution, if it is alkaline or neuter, by the addition of certain acids; and, even if the liquor is acid, by the addition of a number of salts, alkaline, neutral, or acid; or by the introduction of substances capable of forming insoluble combinations with glutine, such as tannin.

Glutine, made in the manner described, is employed for fixing colors on fabrics, paper, textile substances, and others; for painting and varnishing boats, metal, and the like; for giving a finish to, and for preparing, threads, tissues, leather, and paper; and as the gluten can be rendered insoluble, the substances thus treated will be made incombustible, and at the same time they will not be injured by washing; for binding together all sorts of substances, such as wood, stone, glass, metals, stuffs, skins, and the like; for so preparing threads as to give them the strength and appearance of horsehair; for making artificial horn, bone, shells, pearls, coral, and articles manufactured from such like materials; for coating and rendering medicines tasteless; for clarifying all sorts of substances; for the manufacture of beer; for rendering alimentary substances very nutritive; for the manufacture of soap in combination with alkaline solutions; for making imitations in glass, porcelain, pottery; and for many other useful purposes.

The patentee claims, "the method of extracting substances from cereal grains and some of their products, and the application of the substances extracted, in the manner and for the purposes described."

To William Smith *and* Prince Smith, *both of Keighley, Yorkshire, for an improved process of hardening cast-iron caps used in machinery for spinning and doubling wool, cotton, silk, flax, mohair, and other fibrous substances.*—[Dated 18th January, 1860.]

This invention applies to a certain part of the apparatus used in spinning and doubling machinery, known as the "spindle cap," which consists of a cylinder or cone of cast iron, polished externally, and placed on the spindle. These caps, in consequence of their being made of cast iron, have hitherto been extremely liable to be bruised or damaged by a blow

or fall. To remedy this defect, the patentees harden the cast-iron spindle caps by heating them to a red heat, and then putting them into cold water mixed with common salt (chloride of sodium).

The patentees claim, "the method or process of hardening cast-iron spindle caps, by heating them to a red heat, and then plunging the same into cold water, either with or without the addition of chloride of sodium or other suitable chemical salt."

Scientific Notices.

INSTITUTION OF MECHANICAL ENGINEERS.

Continued from page 47.

The paper next read was, "*On Giffard's injector for feeding steam-boilers*," by Mr. JOHN ROBINSON, of Manchester.

THE object of the water injector forming the subject of the present paper, called the "automatic injector," is to feed steam-boilers by a self-acting apparatus, employing the direct application of the steam from the boiler, without the intervention of machinery.

The steam from the boiler to which the apparatus is applied, is admitted through a pipe, governed by a cock, and passes into a perforated cylinder or tube, which is adjustable vertically in the pipe which supports it. This tube is made conical at the bottom, the area of the aperture being regulated by a conical rod, adjusted by a screw and handle with which the rod is fitted. The jet of steam issuing from the conical orifice of the tube encounters the feed-water in a chamber connected with the feed-water pipe; the supply of feed-water is regulated by raising or lowering the tube, by means of a screw of quick pitch, having a loose bearing in a flange of the tube, and working in a tapped shoulder on the pipe which carries this tube. The stream of feed-water propelled by the steam-jet issues from the orifice of a conical tubular prolongation of the feed-water chamber, and passes into the mouth of a pipe set in a line therewith and leading into the boiler; the intervening space between the two pipes being open to the atmosphere, so that the stream of water can be seen through the sight holes in the outer and enclosing pipe, at this part of its passage, while the injector is at work. A check-valve is provided to prevent the return of the water from the boiler when the injector is not working. Any overflow occasioned in starting the injector is carried off by an overflow pipe, and the sight holes are covered by a circular slide.

In starting the injector, the adjustable tube is first brought to the position suited to the pressure of steam in the boiler; this permits the access of water to the instrument and regulates its admission. The steam-cock is then opened, and the screwed rod slightly elevated, which admits a small quantity of steam to the conical tube leading from the feed-water chamber. A partial vacuum is thus produced in the chamber by the rush of steam downwards, and the water flows into it. As soon as this happens, which can be observed at the overflow-pipe, the screwed rod is gradually raised

until the overflow ceases, thus giving full liberty to the steam to act upon the water and drive it into the boiler past the check-valve.

The injector has now been in use upwards of nine months in France, a large number having been put to work there, of which a considerable proportion has been applied to locomotive engines; and these have been found so thoroughly satisfactory, that their application to locomotives, as well as to marine, stationary, and agricultural boilers, is being widely extended: they are especially advantageous for boilers in motion, and when the engines work at high velocities, on account of the certainty of their action, together with their great simplicity of construction and freedom from risk of derangement. Injectors have been working for six months in England, the first having been procured from France by the writer's partner, Mr. Stewart, and tried upon a stationary boiler at their works. It was subsequently put to work upon a ballast engine upon the St. Helen's Railway, where, in the course of a few days, the driver was able to dispense with the use of the engine pumps, and to maintain the level of the water in the boiler by the injector alone. A larger injector was then tried upon a goods engine on the same railway, which proved entirely successful: and the writer, with the kind co-operation of Mr. Cross, the engineer of the railway, made experiments with this and another injector of the same size, manufactured at Manchester, to ascertain what effect the temperature of the feed-water, and the vibrations and concussions caused by the action of the break, passing over crossing points or shunting waggons, &c., would have upon the regularity of the water passing through the instrument. The general result ascertained by these experiments was, that the injector would work at all steam pressures up to the maximum working pressure of the boiler, 110 lbs. per square inch; and would draw water from the tender of any temperature up to 110° Fahr.; and that neither the sudden application of the break, nor any shock produced in passing bad points or in shunting, interfered in any way with its efficient working. The only difficulty which arose was when the water in the tender had become hot, and at the same time very low in level, under which circumstances conjoined, the degree of vacuum capable of being produced in the water-chamber of the injector was not sufficient to lift the water to the height at which it was placed, 29 inches above the footplate; this inconvenience was, however, readily obviated by lowering the injector, so as to bring the water entrance within a few inches of the level of the bottom of the tender. In using the injector, no difficulty was experienced in so regulating the openings for steam and water as to produce a constant and regular supply of any required quantity of water to the boiler, without waste, from the overflow pipe. The result of the continued working of these injectors on the St. Helen's Railway was so satisfactory, that ten of them have been ordered for the engines on this railway: and it has been decided to replace all the pumps of the locomotives on a foreign railway by injectors, after careful trial of one of them.

It may be desirable here to mention some collateral advantages arising from the use of the injector on locomotive engines. The space hitherto occupied by the pumps is saved, and becomes available for other purposes: the power of the engine required to work the pumps is economised, and the wear and tear of the parts through which this power is transmitted is entirely avoided: and the water level can be maintained at any desired height, whether the engine be moving or not; also the steam, often blown

off when standing, can be used for the purpose of forcing water into the boiler.

For the purpose of ascertaining the limits of the circumstances under which the injector can be worked, a series of experiments was made by the writer with instruments of different sizes, fixed to stationary boilers working at 60 lbs. pressure, one of which being connected with an adjoining boiler, in which the pressure could be reduced to any desired amount, gave great facility for measuring the power of the injector when feeding by lower into higher pressures; the relative pressures being accurately observed by Schaeffer's and mercurial steam gauges. The temperature of the feed-water, also, could be varied at pleasure, by introducing into it either hot or cold water, as required. The general results obtained from these experiments were, that water could be forced into a boiler by the injector when the steam pressure was not below 5 lbs. per square inch; that the temperature of the feed-water might be raised up to 148° Fahr., requiring to be varied in the inverse proportion to the pressure of steam; and that surplus power was developed by the instrument, available for forcing water into a boiler at a higher pressure than the one from which the steam was obtained; the injector having been effective with steam of $24\frac{1}{2}$ lbs. pressure above the atmosphere in forcing water into a boiler at $48\frac{1}{2}$ lbs. pressure. In all cases, the surface of the water in the supply-tank was at least 2 feet below the level of the water chamber of the injector; the vacuum in that chamber being from 1 lb. to $1\frac{1}{2}$ lbs. below the atmosphere during the operation.

Mr. C. W. Siemens enquired what increase of temperature took place in the feed-water in passing through the injector, as this would be a measure of the quantity of steam condensed in the jet, and it was important to ascertain the actual expenditure of power in working the instrument. The theory of its action could then be investigated by ascertaining whether the quantity of steam condensed in the jet was sufficient to impart to the jet of water the velocity required for enabling it to overcome the resistance opposed to its entrance into the boiler; for the velocity imparted would be inversely proportionate to the weights in motion, and 1 lb. of steam would impart to 10 lbs. of water 1-10th of its velocity, if no force were lost from friction and eddies in the jet.

Mr. Robinson replied, that there was found to be a rise of temperature of about 60° in the water in passing the injector; the feed-water at 100° being raised to 160°. He showed a specimen of the injector,—taking it to pieces to explain its construction.

Mr. E. A. Cowper asked whether this rise of temperature was measured from the waste water overflowing from the instrument, or from the water in the feed-pipe going into the boiler; the latter, he considered, would be requisite for obtaining the correct result. The instrument was certainly highly ingenious, and an interesting subject for investigation as to the principle of its action.

Mr. Robinson said, the rise of temperature that he had mentioned had been measured only at the overflow, as there was no means of measuring it otherwise at present. The overflow, he further said, was entirely stopped by adjusting the steam and water in due proportion, which took place in a few seconds after starting to work, and the injector then continued working regularly for any length of time without the least over-

flow with a pressure continuing uniform; but the overflow could be caused directly by increasing the water supply or diminishing the steam too much.

Mr. W. B. Johnson had seen the injector at work, and was much struck with its perfect action and extreme simplicity; it was started instantaneously to work without any difficulty, and continued working regularly without the slightest overflow of water; the sight holes could be kept permanently open after it was started in full work, and all that was seen was an apparently solid column of water rushing from one tube into the mouth of the other. He saw an experiment tried whilst the injector was in full work, by inserting a plate between the two orifices to stop the action of the jet; but the stream was instantly established again on removing the interrupting plate.

April 25th, 1860.

The first paper read was, "*On some regenerative hot-blast stoves working at a temperature of* 1300° *Fahr.*," by Mr. EDWARD A. COWPER, of London.

THE practical utility of hot-blast has been so thoroughly appreciated since its first introduction by Mr. Neilson, in 1829, that it now needs no advocate to recommend it to experienced ironmasters. Many plans of hot-blast stoves have been suggested and tried, and various opinions have been expressed on their merits, owing to the same constant care and watchfulness not having been exercised at different works when using stoves of a similar description. It has been found by many careful observers that the results from the blast furnace are so greatly improved by raising the temperature of the blast, that ironmasters have often tried how far they could go in obtaining a higher temperature, and have, of course, soon arrived at a limit, from the destruction which ensued of the cast-iron pipes; and it is obvious that there must always be a wide difference between the temperature of the air heated inside a cast-iron pipe and the fire outside the pipe heating it, as there will be the difference in temperature between the fire and the pipe, together with the difference in temperature between the pipe and the air passing through it. These differences must be considerable, in order to ensure a tolerable rapid conduction of the heat; so that in no case can the hot-blast approach at all near to the temperature of the fire, nor indeed would the cast-iron stand if anything of the sort were attempted. The temperature at which the products of combustion pass away from ordinary stoves is from 1250° to 1500°, whilst the blast is heated only to about 700°. The economy of fuel for real work done must therefore be very low, as the products of combustion must pass away much hotter than the temperature obtained in the blast—say about double the temperature; and when it is attempted to obtain economy in the blast-furnace by increasing the temperature of the blast, economy is further sacrificed in the stoves, by the greatly increased amount of heat which must necessarily pass away: hence the hotter the blast, the greater is the waste of fuel in heating it in the ordinary stoves.

In the plan of hot-blast stoves to which it is now wished to call the attention of the members, the principle of Mr. Siemens's regenerative furnace is adapted for the special purpose of heating blast, and the stove is en-

closed in an air-tight case or skin of metal; by which means it is possible to obtain the blast of as high a temperature as the most refractory material will stand, and to abstract the whole of the heat from the fuel used. This result, it should be observed—great economy with very high temperature—is obtained entirely without any iron surfaces being exposed to an injuriously high temperature, as the whole of the cast-iron pipes and mains of ordinary stoves are entirely done away with, and only firebrick is exposed to the fire.

Mr. Siemens's regenerator (which is in successful operation for melting and heating steel and iron) consists of a chamber, in which are placed a number of pieces of any refractory material, at a small distance apart, so that the heat from the fire can be passed through the chamber amongst them; they thus become heated, but not equally; for those nearest the fire absorb the greatest amount of heat, then those next to them a somewhat less amount, and so on, until at last there is no useful heat left in the products of combustion. For so long as the pieces of refractory material are at a lower temperature than the products of combustion, they will continue to take up some heat, and thus it is impossible for any heat to escape or get through. The next operation is to abstract or utilize the heat so taken up by the regenerator: and this is accomplished by shutting off the supply of heat from the fire, and turning the air to be heated through the regenerator in the opposite direction; so that it comes in contact first with the cool end of the regenerator, and therefore commences by taking up only a little heat; then, as it strikes the next set of pieces of material in the regenerator, it takes up a little more heat, as they are a little hotter than the first; and passing onwards, it takes up more and more heat as it comes in contact with each stratum of heated material, until the air issues from the hot end of the regenerator at very nearly the temperature of that part.

The specific heat of common firebrick has been found to be very great, its capacity for heat being about equal to that of copper, bulk for bulk, and therefore many times as great as that of copper, weight for weight, In comparison with water, bulk for bulk, the specific heat is also nearly equal; and the temperature of the firebrick at the hot end of the regenerator being raised to about ten times that of boiling water, this makes the total capacity of the regenerator near the hot end nearly ten times that of an equal volume of boiling water. Now as the specific heat of air is small, being only one-fourth that of water, weight for weight, a small quantity of heated firebrick will suffice to heat a very large volume of air. The currents of heat and of cold blast require to be changed only once every two hours, to produce a very regular temperature of hot blast; and by increasing the quantity of firebrick, or changing two pairs of stoves alternately, much longer times of changing might be adopted, or even greater regularity of temperature might easily be obtained.

A pair of experimental regenerative hot-blast stoves, erected at Messrs. Cochrane's works, at Ormesby, near Middlesborough, have been regularly working for more than two months, heating nearly 1000 cubic feet of air per minute up to 1200° or 1300° Fahr. These stoves are placed side by side, and heated from the bottom by coal fires, and the heat passes upwards through the regenerator, by which the greater part of it is absorbed, the residue finally escaping at the top, through a valve into the flue leading to the chimney. The fireplace is provided with a sliding fire-door,

made hollow to receive water. It runs to and fro on rollers, and when shut, encloses the fire entirely as well as the ashpit; and being planed to fit its frame, immediately that the pressure of the blast is put on, the door is pressed against the frame, and is made air-tight. At the top of the stove is an ordinary sluice-valve for admitting the cold blast, and the valve which governs the discharge of the hot blast is cast of a hemispherical form, the better to resist the heat to which it is exposed; it does not slide on its face, but is simply lifted up and down, being made flat at the edge, and rests on a rounded seat. This valve answers very well, though for very high temperatures, such as 1400° to 1800°, or more, which it is proposed to reach eventually: it is intended to supply the interior of hot-blast valves with a flow of water like an ordinary water tuyere. Whilst heating up, the sliding fire-door and the chimney-valve are open; and after two hours these are shut, and the hot and cold blast valves are opened. The blast is thus allowed to pass through the regenerator, in the downward direction, for two hours, during which time the other stove of the pair is being heated. The temperature produced by the fire is probably about 4000° Fahr., though no exact experiments have been made on this, for want of an accurate instrument; and the action of the regenerator is so perfect, that the heat escaping through the chimney valve is only 150° to 250°: indeed the hand may be put right into the flue without the slightest injury, showing that, practically, all the heat is absorbed by the regenerator. The cold blast entering at the temperature of the atmosphere, or a very few degrees above, owing to its compression to 3 lbs. pressure per square inch, becomes heated in its passage downwards through the regenerator to 1300°, and the temperature varies only about 100° or 150° during two hours' work with one stove. These experimental stoves, however, were never intended to work for more than one hour changes, as they have only a moderate quantity of firebrick in them, being made out of two pieces of wrought-iron cylinder, 7 feet 6 inches diameter, that were already in existence. The stoves have now been working for more than two months, at the temperature of 1300°, supplying one 3-inch tuyere of a large furnace, and delivering nearly 1000 cubic feet of air per minute. The melting of lead by the blast is a common test for the temperature of the blast in ordinary hot-blast stoves, and with a hotter blast, zinc is used as a test; but with such hot-blast as is obtained by the regenerative stoves, it is necessary to use a metal that melts at a much higher temperature, and therefore antimony is employed, which is melted in some 6 or 7 seconds, and often in even 4 or 5 seconds. The whole of the hot-blast main conveying the blast from the stove to the globe-pipe near the furnace is lined with firebrick, and the muzzle and globe-pipe that are not so lined keep red-hot.

Several experiments were made with these stoves last year, but owing to the great distance that the hot-blast had to travel through pipes not sufficiently lined with firebrick, several hundred degrees of heat were lost in the passage, since upwards of 65 feet length of cast-iron pipe was kept at a good red heat by the passage of the blast through it. The temperature of the blast, at the muzzle, in these experiments, was often 1250°, whilst at the stove it was 1500°, and even 1600°; and at one time, when the stove was pushed too much through carelessness, the blast was heated to within a few degrees of 2000°. With regard to the economy of these fire-heated stoves, it may be judged of by the consideration of the fact, that the heat passing away into the chimneys of ordinary hot-blast stoves

reaches about 1250°; whereas with the regenerative stoves it is only 200°, or even less.

The pyrometer used for measuring the temperatures obtained was on the principle of that shown at a former meeting of the Institution by Mr. John Wilson. The pyrometer consists of an open copper vessel, capable of holding rather more than a pint of water, and well protected against radiation by having two double casings around it,—the inner containing air, and the outer filled with felt. A good mercury thermometer is fixed in it, having, in addition to the ordinary scale, a small sliding scale, graduated and figured with 50 degrees to 1 degree of the thermometer scale: there is also provided a cylindrical piece of copper, accurately adjusted in size, so that its total capacity for heat shall be 1-50th that of a pint of water. In using the pyrometer, a pint of water is measured into the copper vessel, and the sliding pyrometer scale is set with its zero at the temperature of the water as indicated by the mercury thermometer; the piece of copper is then put into the current of hot blast, the temperature of which it is wished to ascertain, and is allowed to become heated for about two minutes, when it is quickly dropped into the water in the copper vessel, and raises the temperature of the water in the proportion of 1 degree for each 50 degrees of temperature in the copper; the rise in temperature may be read off at once on the pyrometer scale, and if to this is added the actual temperature of the water, as shown on the scale of the mercury thermometer, the exact temperature of the blast is obtained.

The advantages that may reasonably be expected from the regenerative hot-blast stoves are twofold. Firstly, supposing that it is only required to use blast of the usual temperature, the advantages of this plan are the substitution of cheap fire-brick surfaces to receive the heat of the fire, in place of the more costly and perishable cast-iron pipes, so that all burning out of pipes and leaky joints are at once saved, while, surface for surface, fire-brick is only 1-100th part of the expense of cast-iron pipes; there is also great economy in fuel, resulting from the fact that all the heat is absorbed in the regenerator before passing away to the chimney. Secondly, the greatest advantage consists in the power obtained of raising the temperature with perfect ease to a much higher degree than ever could be attempted before, and this too with the greatest possible economy of fuel and materials.

The regenerative stoves are particularly well adapted for being heated by the waste gas from blast furnaces, as there are no iron pipes to be injured by the gas flame. If it be urged that there is already more gas generated from one furnace than is enough to heat the blast for it, and that therefore it is unnecessary to think of economy, it must be borne in mind, that when the quantity of fuel in the furnace has been reduced to a minimum by the use of a very highly heated blast, there will probably be only just enough gas made to heat the blast to the desired temperature, as well as to supply the various boilers for blast and lift engine, foundry purposes, &c.; when this has been done, the quantity of fuel consumed per ton of iron made will be exceedingly small, as there will be no heat lost beyond the radiation and that taken away by the melted iron and the cinder.

There are other considerations worthy of the attention of ironmasters with respect to the regenerative hot-blast stoves, such as the decidedly increased make of iron that will result from a furnace of a given size;

the greatly improved power of dealing with certain kinds of ironstone; and the advantage of being able to keep out a large quantity of the impurities always introduced in the fuel, such as sulphur, phosphorus, &c., and thus obtain a better quality of iron.

Mr. Cowper showed a working model of the stove in operation, consisting of a fire-clay cylinder with open ends, having a grating at the bottom; it was filled with broken pieces of fire-brick, which were heated by a gas-burner below, until the lower layers of fire-brick became red-hot. The two ends of the cylinder were then closed air-tight, and a blast of air was forced in at the top from an india-rubber reservoir, which issued at a side jet near the bottom of the cylinder; the heat of the blast at the jet then melted lead, although the heat at the top of the cylinder at the same time was so low that the upper layer of fire-bricks was only slightly warmed, and the paper funnel, which had been used as a chimney to the stove, was not marked or scorched in any way.

In working the pair of coal-burning stoves heating the blast alternately, as described in the paper, some difficulty was anticipated at first in preventing the fire from burning away during the period that the stove was shut and the blast passing through it; but it was found that the fire being situated out of the line of blast, was isolated for the time, and the blast did not pass over it, so that the fire became smothered in an atmosphere of carbonic acid gas, and lay smouldering until the next change; the blast passing across the opening of the fire-flue, but producing no draught through it as the fire-door was closed. When the blast was turned off, and the fire-door opened, the fire was at a dull red, and fresh fuel being thrown on, it burned up at once and began to heat up the regenerator again.

There was no difficulty in preserving the bearing bars of the fire-grate from giving way whilst exposed to the high temperature of the blast for the two hours, for by using water pipes as the bearing bars, with a constant stream of cold water running through them, they stood perfectly; the sides of the fireplace were also similarly protected by water boxes, and the sliding door was made hollow with water inside, having india-rubber water pipes to and from it like a water tuyere, allowing the required extent of motion to the door. This construction had proved quite successful in preventing any injury from the intense heat, and the circulating water flowed away only moderately heated; it was proposed, also, to use hollow valves filled with water for the hot-blast valves in the stoves now about to be put up, in which still higher temperatures would be employed.

Mr. C. W. Siemens explained the action of the pyrometer employed for measuring the high temperatures of blast that had been obtained with the new stoves. A pint of water, having been accurately measured and poured into the vessel, the sliding scale of the pyrometer was set up with the zero mark at the temperature of the water, as shown on the scale of the mercury thermometer, and a cylindrical piece of copper, made of such a size that its total specific heat should be 1-50th that of a pint of water, was held on a wire and put into the ordinary testing hole behind the tuyere, and held in the blast for two minutes. It was then suddenly thrown into the vessel of water, and the rise of the mercury thermometer in the water was read on the pyrometer scale, which was graduated in proportion to the relative specific heat of the copper cylinder and the

pint of water, so that each degree of temperature of the mercury thermometer was read as 50 degrees on the pyrometer scale; then, by taking the reading of the pyrometer scale, and adding the reading of the mercury thermometer for the actual temperature of the water, the exact temperature of the blast was obtained.

Mr. J. B. Neilson said it was always a great pleasure to him to see any improvement made in connection with hot blast, as he had taken so strong an interest in its extension ever since first inventing it more than thirty years ago. He was much struck, on hearing the paper on hot-blast ovens, by Mr. Marten, read at a former meeting, with the value of the magazine of heat that existed in the large fire-brick core filling the centre of the oven then described, which had the effect of regulating the temperature of the oven, and preventing fluctuations arising from irregularities of firing; and in the new regenerative ovens that had now been described, the great capacity of fire-brick for heat had been well taken advantage of, and a very important step in advance had been made, by giving the means of raising the temperature of blast much above the extreme limit practicable with the present ovens, and he considered this would be productive of the greatest benefit in the working of the blast furnace.

The great improvement effected by the use of hot blast lay in raising the temperature in the blast furnace to such a degree, that there was always a sufficient margin of heat above the point of fusion of the iron ore, to ensure regularity in the make of iron; for in cold-blast furnaces the heat could only just be raised to the melting point of the ore, and the least deficiency of fuel, or a slight increase of moisture in the blast, lowered the temperature below the melting point, and interfered with the proper working of the furnace: so little indeed was the heat obtained in a cold-blast furnace above the melting point, that even the additional moisture contained in the blast on a hot day was sufficient to bring on a change from white to black slag in the working of the furnace. But the use of hot blast gave a great additional power of managing the furnace, by raising the temperature so much above the melting point that no fluctuations ever brought it down low enough to cause injury. The great advantage of hot blast, in this respect, became sufficiently apparent even when the temperature was raised only 50° or 100° in its first application; and therefore the very great increase of temperature, now obtained in the new regenerative ovens, must be expected to be attended with most valuable results in increased yield of furnace, and superior quality of pig, owing to greater regularity of temperature in the furnace. There might, perhaps, be some little trouble at first, he thought, in managing the alternate working of a pair of ovens, but this would soon be got over; the great point, however, in the regenerative ovens was, that the whole heat of the fuel was there taken up and given out into the furnace by the blast. Where high heats were employed with the present ovens, a great amount of heat was lost by passing off to the chimney, which it was not possible to take up and make use of in the present construction of ovens; but in the new oven, it was astonishing how small a quantity of heat escaped into the chimney, and this must cause a great saving of fuel. The high temperature of blast of 1300° obtained in the regenerative ovens appeared, at first, scarcely credible; but the statements that had been given of their construction and working showed that this temperature was quite practicable, and even higher temperatures might be attained.

He had always wanted to get a very high temperature of blast, and was convinced that now the advantages of increasing the temperature of hot blast had been so clearly established by experience, advantage would be taken of every means to raise it still further. The only question on which he felt some doubt at present was, whether the inside of the blast furnace would stand the very high heat obtained; for before bringing out the invention of the hot blast, he had tried its effects in a small furnace three feet high and twelve inches diameter, in which he got the temperature up high enough to melt the scoria from the copper works, and obtained No. 1 cast iron from it; but the inside of the furnace was also melted down by the very high temperature. But even if the heat should prove so intense as to make it difficult to keep the furnace in order, it might still be practicable to get over this by some plan of water casing to protect the sides of the furnace from injury. In this small experimental furnace, the first spiral water tuyere was used, imbedded in fire-clay, which was now replaced by the cast-iron water tuyere.

There was another advantage, he believed, attendant upon the increased temperature of blast obtained with the regenerative ovens, which consisted in lowering the height of the point of fusion above the tuyeres. By the present use of hot blast, the melting point was already brought down to within, say, about 8 inches of the tuyeres, and with the blast raised to 1300° or 1500°, he thought it would probably be within 2 or 3 inches of the tuyeres, which would prevent the newly melted iron from being exposed so long to oxidation by the blast, and thereby save waste of iron in the furnace. The saving in fuel effected by the regenerative ovens would be twofold, since there would be less fuel required for heating the blast now that all the heat was made use of, and also less fuel and lime consumed in the blast furnace, owing to the increased temperature of blast; while, at the same time, more iron would be produced in the time, and of more uniform quality. He did not think there was any danger to be apprehended of injuring the quality of iron by using a hotter blast; for some years ago, it was feared by many, that if the blast were heated above 300° the iron would be spoilt for foundry purposes; but now it was already heated to 700° or 800° without any such detrimental result being experienced, and he therefore looked forwards to the use of still better blast without fearing any injury to the iron.

The regenerative system, which had been so well carried out in the ovens now described, appeared to him to be applicable with advantage to a great variety of manufactures where at present a great amount of heat was wasted by being allowed to escape into the chimney, which might be intercepted and made use of by means of a regenerator. He thought the application of the plan to gas retorts would be very desirable, for at present the heat in the flues escaped into the chimney as hot as the retorts themselves, and almost as hot as the fuel.

Mr. C. W. Siemens thought the hot-blast stove that had been described was one of the most complete and satisfactory applications of the regenerative system yet made; the perfect regulation of blast obtained by it, and of the chemical operations in the blast furnace, was a highly important point of superiority over the present stoves. He had been for many years working at the introduction of the regenerative principle, in order to utilize the whole of the heat given out in the combustion of fuel, and had applied it already in furnaces for heating and melting glass, iron,

and steel, in some cases with great success. The difficulty attending its adoption had never been with the regenerator itself, but in the mode of carrying out the special application, so as to accommodate it to the particular requirements of each manufacture.

For heating the regenerator, he was decidedly in favor of using gas instead of coal, for a coal fire gave out a very great and unnecessary heat in the fireplace by radiation, requiring special protection of that part to prevent injury; while gas produced less heat at the actual point of ignition, but quite a sufficient temperature in its combustion. In these hot-blast stoves the regenerative system was carried out very well indeed, particularly in the coal-burning stove, considering the difficulty of shutting in the fire while the blast was on; but in firing with gas, this difficulty was done away with; the gas valve was simply shut at the time of change, and all the flame went out, and was then lighted again at the next time of heating up the regenerator. In working the regenerative stoves, he thought it was not desirable to get up an intense heat much beyond that to which the blast was required to be heated, in order not to expose the material of the stoves to an unnecessarily high heat, and on this account gas appeared preferable to a coal fire; for gas, in burning, gave a temperature of about 2000°, and would heat the hottest end of the regenerator to that degree, and then in the return course the blast could be heated nearly to the same temperature, which was at present quite as high as could be made use of. He was so convinced of the superior advantage of gas for heating, that in some cases, where he had not got the waste gases from the blast furnace to use, he had purposely made gas producers, in order to obtain gas from the fuel for burning, instead of burning the fuel direct. A large quantity of fuel was laid on a grate in a very thick layer, say about three feet thick, and ignited from the bottom, with a slow current of air passing up through it; then, as the carbonic acid formed at the bottom passed upwards through the fuel above, it formed carbonic oxide, which passed off at a moderate temperature of about 300°, mixed with the carburetted hydrogen distilled from the coal, and was conveyed to the stove where the heat was required, and there burnt, by admitting the required proportion of atmospheric air.

Mr. C. Cochrane observed, that the hot-blast stoves put up at his works at Middlesborough, were heated with coal fires, as had been described; but where there was any difficulty in burning coals he could confirm the advantage of using gas for heating the stoves. He had seen one of the regenerative gas furnaces employed at Messrs. Naylor and Vickers's works, at Sheffield, for melting steel, which was working successfully.

Mr. J. B. Neilson asked, what were the cubic contents of the fire-brick contained in the regenerator in these hot-blast stoves, and the quantity of fuel required to heat them, with the time of heating and the quantity of blast passed through. At present, about 5*s.* per ton of iron made was the general cost for heating the blast to the temperature of about 700° or 800°.

Mr. C. Cochrane replied, that each of the new stoves at his works was 9 feet deep and 5 feet 10 inches diameter, containing 250 cubic feet of fire-brick, and heating 1000 cubic feet of air per minute to 1200° or 1300°, the temperature falling to 1150° at the end of each change, or only 150° variation of temperature altogether; the stoves worked alternately, being changed every two hours. As regarded the consumption of fuel for heat-

ing the blast, the result of eight weeks' work was a consumption of 6 cwts. of coal per ton of iron with the new stoves, instead of 5½ cwts. with the ordinary stoves; but then, with ½ cwt. more in the new stoves, the blast was heated some 350° higher. In the present case, however, the new stoves had been working under considerable disadvantages, and there were some defects in construction that would be corrected in the next stoves made on this plan. The iron casing of the stoves was lined with only nine inches thickness of fire-brick, which it was afterwards found ought to have been fourteen inches at least; and the fireplace was three feet further than it need have been from the stove, as it had been proposed at first to introduce a damper between the fire and the regenerator, in order to shut off the fire when the blast was on, but this was found to be quite unnecessary. When the new stoves were tried under proper conditions, without these disadvantages, and of large size instead of small, he was satisfied that great economy of fuel would result.

Mr. H. Marten was much pleased to see this further extension of Mr. Neilson's original idea of the hot blast, and was convinced that great improvement might be made over the present stoves, so as to obtain a hotter blast. There had been no experience yet of the regenerative stoves in the Staffordshire district, but it was clear that when radiation was so thoroughly prevented as in this case, all the heat imparted to the brickwork must be communicated to the blast and go into the furnace, which would produce great economy of fuel besides giving a much hotter blast than was practicable with the present stoves. He enquired what was the cost of the new stoves.

Mr. Cowper replied, that the cost of a complete set of four stoves for heating 6000 cubic feet of air per minute for one blast furnace would be about £1800 if heated by fires, and a set of four gas stoves would cost about £1400; but if the stoves were made larger, so that two would be sufficient for a furnace, the cost would be less. The cost of heating the blast by the new stoves would not be more than one-half or one-third, he believed, of that with the ordinary stoves, while the blast would be heated up to 1200° or 1500°, instead of only 700° or 800°.

Mr. H. Marten observed, that the cost of the present oval ovens, of the most economical make, as erected at the Parkfield Iron Works, was about £500 or £600 for supplying seven or eight tuyeres with blast at a temperature of 700° or 800°, and the consumption of fuel was generally about 6 to 7 cwts. of slack per ton of iron made. The iron heating pipes in the present ovens were reckoned to last about seven or eight years with no material repairs; but the new regenerative ovens described in the paper would certainly be less liable to want repair, as there were no iron pipes or joints to leak in them, and the interior was made entirely of a very indestructible material.

Mr. Samuel Lloyd asked, whether any increase in make of iron had been caused by the new stoves. They had made a trial of a considerable increase in temperature of the blast some years ago, at the Old Park Iron Works, and heated it up to about 900°, by passing it through a second ordinary stove near the tuyere; but the make of iron was not found to be increased as compared with that produced at the ordinary temperature of 600° or 800°.

Mr. C. Cochrane said, the make of iron had been the largest whilst the

new stoves were used, but the effect was not at present sufficiently marked to enable him to state whether it was due solely to the increased heat of blast. The new stoves had been put up to test the practicability of applying the regenerative principle, and supplied blast to only one tuyere out of five, so that the addition of 350° to the blast at one tuyere was equivalent to only 70° at each tuyere, which was little more than the fluctuations of temperature that the furnace was already exposed to with the ordinary stoves, and not enough to afford definite results. A high heat of blast could not be tried properly with the ordinary stoves, as the iron heating pipes would soon be melted down with any great increase of temperature beyond that at present obtained with them.

Mr. J. B. Neilson had no doubt the make of iron would be considerably increased by the higher temperature of blast given by the regenerative ovens; for in his first experiments on the use of hot blast, though he could not get more than 70° or 80° rise of temperature, this was enough to produce a decided increase in make of iron. He was therefore in favour of heating the blast to as high a temperature as practicable; possibly, if a blast sufficiently hot could be employed, the iron ore might be melted with lime only, without any coal, except what was required to carbonize the ore; provided that the heat in the blast furnace was not so great as to bring down the furnace itself.

Mr. Cowper, in answer to a question from the chairman, stated that the royalty was 6*d*. per ton of iron made: a set of gas stoves was now being applied to a large furnace in the north of England, and the results obtained when they were got to work, would give the means of ascertaining the extent of their economy.

The following paper, "*On Pinel's magnetic water gauge for steam-boilers*," by Mr. George Piggott, of Birmingham, was next read.

Most appliances for indicating the height of water in steam-boilers are liable to be inefficient for the purpose, chiefly from undue friction caused by the float-rod passing through a stuffing-box or packed joint: the packing is often so tight that the float will not move the rod; and if it is packed lightly, to dispense with the friction, then there is a leakage of steam which is very objectionable. The magnetic water gauge described in the present paper, the invention of M. Pinel, of Rouen, is free from these objections: the chief points to be noticed are, its compactness and simplicity, and the facility of fixing, its exactness in working and durability, and the very little attention required to keep it in working order.

The gauge consists of an upright cast-iron pipe, on the top of which is fixed a brass box, square in cross section. Passing through a bush at the bottom of this pipe, at the part where it is attached to the boiler, is an iron rod, to the lower end of which a hollow cylindrical float, proved to stand a pressure of 10 atmospheres, is attached. The upper end of this rod carries a strong horse-shoe magnet, the poles being bent forward at right angles to the body of the magnet, which falls or rises in the brass box with the fall or rise of water in the boiler. On the exterior face of the box is an isolated iron needle, held merely by the attraction of the poles of

the magnet, which it follows in all its movements, rolling on the face of the box as the magnet rises or falls, according to the height of water in the boiler. The face of the box is silvered and graduated, so that the least movement of the needle is perceptible: it is covered with glass, to protect it from dust and injury. On the side of the upright pipe a shrill whistle is fixed, closed by a valve kept shut by the internal pressure of steam: when the float is nearly at the lowest limit of its range, a small stud on the float-rod presses on a lever, which immediately opens the valve and allows the steam to sound the whistle; this at once makes known the want of water.

The fixing of the gauge is exceedingly simple, and does not allow any leakage of steam, which is not only a waste, but often injures the plates of a boiler. A hole, about 1¼-inch diameter, is drilled in the top of the boiler, at the required place, and the gauge is fixed upright, the joint being made with india-rubber, and a nut screwed on inside the boiler. The length of the float-rod is adjusted to suit the height of water it is usual to work at, the float being weighted to sink just half way in the water, so that the adjustment is reduced to a mere matter of measurement; the needle points to zero when the water is at its proper working height, and the water level may then be lowered 2½ inches before the whistle sounds; but if it exceeds this limit by ⅛-inch, the whistle will sound the alarm, and will continue to whistle till the water level is raised again. The gauge is sometimes constructed with two whistles, for high and low water. The float-rod is limited in its motion both upwards and downwards. When the water is raised 6 inches above the proper working height, the coupling of the rod comes in contact with the bush through which it slides, and the magnet is thus prevented from being forced against the top of the gauge; and when the water falls more than 3 inches below its proper level, the brass coupling, which joins the magnet to the rod, rests on the top of a fixed guide, holding the float suspended till the water is raised high enough to float it again: this prevents the magnet from moving out of the brass box. The brass box is planed on the back and front, and for a portion of the width on each side, forming a guide for the magnet to slide in. On the back of the magnet is fixed a brass bar, bearing only on the planed surface on each side of the box, by which the magnet is made to slide perpendicularly: immediately under this bar a light spring is fixed to the back of the magnet, also bearing only on the back of the box, which keeps the poles of the magnet slightly pressing against the face.

This water gauge indicates the height of water so exactly, and the absence of friction renders it so sensitive, that the writer has noticed, when it has been put just over the fireplace of a double-flue boiler, with brisk fires going, that the needle rises and falls with the fluctuation of the water caused by the quick ebullition. The gauge requires scarcely any attention, and the inconvenience of constantly greasing and watching that the float acts, is entirely done away with. The silvered face is kept clean by washing with soap and water two or three times a year: this is all the attention it requires.

The total number of these gauges now at work is 3500, 65 of which are in England, and the remainder principally in France; all of which are working with as much accuracy as when first put up, and some of them

have now been nine years at work. The rubbing of the magnet against the brass box gives it a polish that renders the wear inappreciable: its magnetic power must necessarily be weakened in time from the effects of rust, and it would then require renewal, but at present its durability has not been impaired in any way. As there is no passage of steam through the gauge, the interior is not liable to any incrustation or deposit. Magnetic gauges were put up at the Paris Mint in 1855, and have never been touched since that time: they have also been adopted extensively in the French Government workshops and in manufactories.

A specimen of the gauge was exhibited, taken to pieces to show the construction.

Mr. W. F. Batho had had three of the gauges at work at a pressure of 30 lbs. to 40 lbs., the longest for 8 months; no injury had occurred to them, and they continued in good working order. The only danger that could arise would be from the magnet becoming corroded by long exposure to the steam, and in one of the gauges that had been taken down recently and taken to pieces to be examined, there was a slight indication of corrosion commencing on the magnet.

Mr. J. B. Neilson thought the magnetic water gauge would be very useful, especially for boilers with internal flues, where it was so particularly important to know the water level correctly. He thought the hollow float exhibited appeared rather light for working the gauge, and that a stone float would be preferable, as safer and more durable, if it could be arranged to be counterpoised. He enquired what was the cost of the gauge.

Mr. W. F. Batho replied, that the gauge cost £7. 10*s*. or £7. 15*s*.

Mr. W. Richardson had used a different construction of magnetic water gauge, on a boiler working up to 50 lbs. pressure, situated in a forge, where he was afraid of a glass gauge being exposed to injury, and wanted a gauge that would not be too high up to be easily seen. It consisted of a copper float, about 7 inches diameter, fixed on a lever, the horizontal spindle of which passed freely through the front of the boiler into the casing of the gauge, without any stuffing-box or packing, and carried at its outer extremity a bar magnet, fixed at right angles to the spindle and parallel to the float lever, working within the casing of the gauge: outside the casing was a steel indicating finger, working loosely on a pin in the same centre line as the spindle of the magnet, which showed the height of water on the dial plate. The magnet and indicating finger both rotated on the centre point of their length, so that both were completely balanced, and the finger was propelled by each end of the magnet. This gauge had now been at work for 18 months and continued perfectly correct; when first put up, immediately over the fire, its sensitiveness was so great, from the violent ebullition, that the index was very unsteady; and in order to keep the surface of the water quiet a piece of sheet iron had to be fixed horizontally inside the boiler, sufficiently below the surface of the water not to interfere with the range of the float.

Mr. C. W. Siemens had seen a magnetic water-gauge brought over from America about fifteen years ago, similar to the gauge just referred

to, having a radial needle worked by a magnet attached to the float, but had not seen it put into operation.

Mr. G. F. Muntz observed, that there was one advantage in the magnetic gauge described in the paper, that if the magnet ever got out of order and lost its power, the needle would drop down to the bottom of the face, and it would become evident that the gauge was not in working order; but in most gauges having a finger, the finger did not drop when the gauge got out of order, but remained pointing to the dial, and apparently indicating the water level.

Mr. E. A. Cowper thought the principle of the magnetic gauge was a good one, as it did away with the friction of the stuffing-box required in ordinary gauges, which was always liable to be packed too tight and check the action of the gauge. One advantage in the construction of the gauge now shown was, that the needle was made with a small ring round it at each end, so as to roll on the face, instead of sliding, which made its motion very easy.

Mr. F. J. Bramwell remembered a magnetic gauge being proposed by Du Trembley several years ago, having a magnet working inside a tube with a ring attracted by it on the outside, but there would be more friction with a ring than with the rolling needle of the gauge now shown.

Mr. C. May remarked, that if a glass tube were fixed on the top of the gauge and could be kept clean, the top of the float-rod itself might be seen working within it, and there would be no need of a magnet or an external ring.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

August 4th, 1860.

MR. J. NEWTON, PRESIDENT, IN THE CHAIR.

The paper read was, "*On water, and some of the phenomena attending the generation of steam,*" by Mr. JAMES STABLER.

THE author began by adverting to the known laws of heat and evaporation, and came finally to consider the causes of steam-boiler explosions. Those causes, he said, were enveloped sometimes in much mystery, and the various theories in relation to them were, to a certain extent, inconclusive. Mr. Colburn, he thought, had rendered good service by his pamphlet on the subject, and, with the views of that gentleman, his own experience made him, to a great extent, coincide. A discussion followed the reading of the paper, and in this Messrs. Briggs, Buckle, Carpenter, Warner, Jones, Chillingworth, and the Chairman joined.

Scientific Adjudication.

HOUSE OF LORDS,—July 19th, 1860.

The Lords present were the Lord Chancellor, Lord Cranworth, Lord Chelmsford, and Lord Wensleydale.

SEED *v.* HIGGINS AND OTHERS.—HIGGINS AND OTHERS *v.* SEED.

These were cross-appeals, springing out of an action originally brought by Mr. Seed, against Messrs. Higgins and Co., in the Court of Queen's Bench, for an alleged infringement of a patent for certain improvements in machinery or apparatus for preparing, slubbing, and roving, cotton and other fibrous substances.* At the trial, before Lord Campbell, at the London sittings after Trinity Term, in 1857, a verdict was found for the plaintiff; leave being reserved to the defendants to move the Court whether the plaintiff's specification, as altered by his disclaimer, claimed a different invention from that for which the patent had been granted. It appeared that the invention in question related to the application of centrifugal force, in place of a spring, to a "presser" used for the purpose of pressing the cotton close upon the bobbin when being wound thereon. The excellence of the invention consisted in its causing the presser to press with equal force upon a full or empty bobbin; whereas, the spring presser pressed harder upon a full than upon on empty bobbin; the result being, that in the former case the cotton was wound equally tight throughout, and in the latter the core was soft and the outside hard.

The Court of Queen's Bench discharged a rule, obtained by the defendants, to show cause why the verdict for the plaintiff should not be set aside and entered for the defendants.

The Court of Exchequer Chamber, upon appeal, decided that the the plaintiff's patent was good, but that there was no evidence of an infringement by the defendants, and they therefore directed a new trial.

The plaintiff, Mr. Seed, next appealed to the House of Lords, against this decision, on the ground that the judgment of the Court of Exchequer Chamber ought to be reversed, and the decision of the Court of Queen's Bench affirmed. On the other hand, the defendants, Messrs. Higgins and Co., contended that the judgment of the Court of Exchequer Chamber ought to be reversed, and that the judgment of the Court of Queen's Bench should not be affirmed; but that the verdict for the plaintiff should be set aside, and a verdict entered for the defendants.

The learned counsel who appeared were the Solicitor-General, Mr. M. Smith, and Mr. Hindmarch, for Mr. Seed; and Mr. Knowles, Mr. Grove, and Mr. Webster, for Messrs. Higgins and Co.

At the conclusion of the arguments, which were heard on the 5th June, the judgment was deferred. Their Lordships now, however, proceeded to pronounce judgment, as follows:—

* For report of this trial, see Vol. VI., p. 174, Lond. Jour.

JUDGMENT.

The Lord Chancellor,—My Lords, on the appeal by the defendant below against the plaintiff below, I am clearly of opinion that the judgment of the Court of Exchequer Chamber ought to be affirmed, for the reason assigned in delivering the judgment of the Court of Queen's Bench, which was affirmed by the Court of Exchequer Chamber.

The appeal by the plaintiff below against the defendant below raises the question, whether, at the conclusion of the plaintiff's case, the presiding judge ought to have directed a nonsuit on the ground that although the novelty of the plaintiff's invention might be established, there was no evidence of infraction. This depended upon the examination of two scientific witnesses of great experience and respectability, who are much more familiar with such machinery than any judge on the bench. They, after having described the plaintiff's machine and a machine of the defendant's, manufactured and sold by him (which was the alleged piracy), swore as follows :—"That there was not any substantial difference between them; that the defendant's presser so far resembled the plaintiff's in the peculiar distinctive quality of bringing the weight nearer to the source of motion; and by bringing it higher up the leg, there was less tendency to create that vibration which was fatal to Dyer's presser; and that this was the distinctive property and advantage of the plaintiff's presser; and that the defendant's gives the peculiar advantages of the plaintiff's in a great measure." These witnesses may be considered as saying that the defendant's machine sought to obtain the same object as the plaintiff's, and substantially by the same process.

I must confess that I have still greater difficulty in seeing how, while these witnesses stood uncontradicted, the judge could have at once withdrawn the case from the jury. Contradictory evidence was afterwards adduced by the defendant, but this could not strengthen the renewed application for a nonsuit. When novelty or infringement depends merely on the construction of the specification, it is a pure question of law for the judges; but where the consideration arises how far one machine, or a material part of one machine, imitates or resembles another in that which is the alleged invention, it generally becomes a mixed question of law and fact, which must be left to the jury. In the present case, the plaintiff certainly was not entitled to a verdict, without proving that the defendant had substantially used that particular mode of roving cotton to which his disclaimer confined him. No exception was taken to the manner in which the question was left to the jury. There might be a wrongful and actionable imitation of the plaintiff's machine, although it was not closely copied in all respects; and the degree of similitude or difference, which is or is not to constitute piracy, seems, generally speaking, to savour more of fact than of law. In the present case, the difference chiefly relied upon was, that the centrifugal force acts on a higher plane in the plaintiff's machine than in the defendant's. This was a very fit topic to be addressed to the jury, but I must very seriously doubt whether the judge would have been justified in stopping the trial, by saying that there would be no infraction, unless, in both machines, the centrifugal force acted exactly in the same plane.

However, notwithstanding these doubts, as I understand that my noble and learned friends, who heard this appeal argued at your lordships' bar, agree in thinking that the judgment of the Court of Exchequer Chamber on this point was right, I have not so strong an opinion in the contrary direction as to force me to dissent, and I shall concur with them in advising your lordships that, upon both appeals, the judgment be affirmed.

Lord Cranworth,—My Lords, in this case the Court of Exchequer Chamber directed a new trial, because, in their opinion, there was no evidence of infringement.

Seed, the plaintiff, has appealed because he says there was evidence, and that therefore he ought to be allowed to maintain his action. Messrs. Higgins, the defendants, have appealed because they say the invention now relied on is not that for which the patent was granted. The Court of Queen's Bench, on the

latter point, were unanimous in favor of the plaintiff; and a majority of the judges in the Court of Exchequer Chamber concurred.

I adopt the same opinion. I think, reading the specification in a fair spirit, we must understand the patentee to have said that he claimed, as his invention, the application of centrifugal force to the flyers, in the mode elaborately explained in his diagrams; but that he did not confine himself to that mode; that he claimed further the application of the principle of centrifugal force to flyers used in machinery for preparing and roving cotton, in whatever way it might be applied. The effect of the disclaimer was to strike out of the specification this latter general claim, leaving only the claim for the particular mode of application specially described. I think it would be unreasonable and hypercritical to say that, on a specification so framed, the patentee had not claimed as his invention, or as part of his invention, what he had so described; and when, therefore, by the disclaimer, the general claim is abandoned, the particular claim remains good. This disposes therefore of the cross appeal. On the original appeal I think that the Court of Exchequer Chamber was right in holding that there was no evidence of infringement, and so that there must be a new trial. By the disclaimer, the right of the plaintiff was confined to the application of centrifugal force by means of a weight acting on a presser, so as to cause it to press against a bobbin—a weight working in a plane above the rest of the machinery, as described in the specification. There was no evidence of the defendants having so applied centrifugal force. Their machine had no weight. The weight referred to in the specification is a distinctive part of the machinery. The claim is not for the application of centrifugal force by means of weight acting on a presser, but by means of a weight and of a weight acting in the manner minutely described in the specification. This is not the case of an equivalent. What the defendants did, was to obtain the advantage of a pressure by means of centrifugal force, obtained without a weight acting in the manner described by the plaintiff, and forming an essential part of his claim. If the machine of the defendants is an infringement of the plaintiff's patent, then he, in truth, retains the benefit of all which he has disclaimed. I am, therefore, of opinion that the judgment of the Exchequer Chamber was right, and so that both appeals ought to be dismissed.

LORD WENSLEYDALE,—My Lords, there are two questions for your lordships' decision in this case. The first,—whether the defendant is entitled to have a rule to enter judgment for him on the point reserved. The second,—whether, upon the evidence stated in the case, agreed upon between the parties, there was any evidence to go to the jury of an infringement of the patent as limited by the disclaimer.

Upon the first question, which is, whether, after the disclaimer, entered pursuant to the Statute 5th and 6th William IV., chapter 83, the patent was good for the particular machine described in the specification; I certainly have had a doubt whether the judgment of the court below was right on this point, and that doubt is not altogether removed; I do not think this is the sort of case to which the statute was meant to apply. The patent is for every sort of application of the law or principle of centrifugal force to flyers used in machinery or apparatus for slubbing and roving cotton, &c., and not for a particular machine or machines, and the disclaimer is founded on a false suggestion (for false certainly it was), that the patentee's claim might be construed to be more extensive than he intended. That appears to me to be quite a fiction. It is now converted into a patent for a particular machine. But my doubt is by no means such as to induce me to dissent from the united opinions of the judges of the Court of Queen's Bench, and the opinions of the majority of the judges of the Court of Error; and, therefore, I agree that the judgment must be affirmed on the point reserved by Lord Campbell on the trial.

The other question is then to be considered, whether there was any evidence to go to the jury of the infringement of this patent right of the defendant. That this question is open upon the rule pronounced by the Court of Queen's Bench

has been already decided by your lordships. We are now to assume that the patent was for the machine described in the specification and drawings annexed, for the application of centrifugal force to the flyers employed in roving, and for that machine only, and the question is whether it has been infringed by the defendant.

The question of infringement is one of mixed law and fact. The construction of the specification is for the Court, with the aid of such facts as are admissible to explain written documents. In deciding whether there has been an infringement, there is a question of fact wholly for the jury, viz., What the defendants have done,—and if scientific evidence is necessary fully to elucidate the case on either side, it is no doubt admissible, and the Court must apply what the jury find to be true in determining the question of infringement. This is generally done in summing up the case by the judge,—he leaving the necessary facts to the jury, and giving, conditionally, the necessary directions in point of law. The opinion of scientific witnesses is only admissible as proof of facts. Their opinion as to whether there has been an infringement or not, though sometimes received, in order to save time and trouble, is strictly speaking inadmissible, and, if objected to, ought to be rejected. The Court alone is to decide questions of law.

The question for your lordships in this case is, simply, whether the facts proved by the witnesses, and set out in the case, were sufficient evidence which ought to have been left to the jury as proof of infringement by the defendant,—that is, were they such as, if the jury believed them to be true, would warrant them in finding that there had been an infringement of this patent for the particular machine described in the specification.

I have come to the conclusion that the unanimous opinion of the Judges of the Exchequer Chamber on this question is correct, and that when all the evidence stated is considered, there was not sufficient to warrant the jury in finding that verdict, and that the plaintiff ought to have been nonsuited. The Court of Queen's Bench seems to have given too much effect to the opinions of Messrs. Carpmael and May. In this case, the models of both machines are brought before us, and would be brought before the jury, and, judging from them, we see for ourselves that though they both answer the object of applying centrifugal force to the flyers, they do it in a different way. The plantiff's wire is distinct from the flyer; he uses what is, in common parlance, a weight, and that weight is at the end of a perpendicular wire at the top of it, and could not be put lower without interfering with the bobbin. The defendant does not use such a weight; he distributes weight by a sort of case round the bottom part of the flyer,—the centre of gravity being lower than the middle of the flyer. The evidence of the scientific witnesses cannot alter these facts, and their opinion that one machine is a piracy of the other is of no consequence whatever, for that is a question not in their province to decide. They prove—and indeed that is evident from the models—that, in the plaintiff's, the centrifugal force operates on a higher plane than the defendant's, and that, in that respect, the plaintiff's is a better invention than the defendant's. But that shows that the machines operate differently, though they both operate on the finger or presser by centrifugal force, and if the subject of the patent still were *any* mode of applying centrifugal force to the finger or presser, undoubtedly the defendant's machine would have been an infringement; but the disclaimer puts an end to that argument, and the patent being for a particular machine only, which clearly operates differently, it seems, I own, to be very clear that one is not a piracy of the other. It is only by confounding the patent as it was with the patent as it is, that an infringement of the patent can be made out. Therefore, I think that your lordships ought to affirm the judgment, and that there should be a new trial.

LORD CHELMSFORD.—My lords, there are two questions in these cases,—first, as to the validity of the disclaimer; second, as to the evidence of infringement.

Upon the first point, I am of opinion that the disclaimer did not extend the rights granted by the letters-patent, nor did the specification, as altered by the disclaimer, describe another and a different invention from that for which the patent

was granted. The plaintiff, by his original specification, shows that he considered himself to be the first discoverer of the application of centrifugal force to that part of the machinery for roving cotton by which the sliver or roving is wound upon the bobbin. But it is evident that the idea which led to his taking out his letters patent was the application of the principle of centrifugal force to flyers, as embodied in the machine which is described in his specification and drawings. Acting, however, under the impression that he was the first discoverer of the application of the principle generally, he proceeds, after the description of his specific machine, to state that he does not intend to confine himself to the particular method represented, but that he claimed as his invention "the application of the law or principle of centrifugal force to the particular or specific purpose above set forth."

Now there may be some doubt whether, upon a claim so general, his patent would have been sustainable, but, at all events, if any person had previously applied centrifugal force in any manner to the flyers, for the purpose of winding the cotton on the bobbin, the letters patent would have been void. The plaintiff, therefore, having probably heard of Dyer's patent, proceeded to enter a disclaimer. Assuming that the specification had been originally bad, on account of the generality of the claim, I see nothing in the Act of Parliament which prevents such an objection as this being removed; the only limitation to a disclaimer of any part of the specification being that it shall not extend the exclusive right granted by the letters patent. Whether the disclaimer in this case does extend the right must depend upon the construction of the original specification. Now I do not understand the specification to claim, as the plaintiff's invention, the application of the law or principle of centrifugal force generally to flyers, and then to describe and exhibit the particular machine as an illustration of the mode in which that general principle might be carried into effect, but it appears to me that the plaintiff first claims the particular method described, and afterwards every other application of centrifugal force to the purpose set forth. Then, when he disclaims all application of the law or principle of centrifugal force, except only the application of centrifugal force as described in the specification, he does not abandon the whole of his invention, and leave himself nothing but an illustration of it; but he gives up all that is general, and limits himself to the particular method, which was a substantial and independent claim, to which the general claim was superadded. In this view, the disclaimer certainly does not extend the right, nor can it be said to describe a different invention. But, the disclaimer having thus narrowed the claim, and having fixed it to the precise and particular machine described, the question of infringement is brought to a very simple point. This question must, necessarily, be one of fact, because it depends upon something which has been done by the defendant by which the plaintiff's right is alleged to have been invaded; but it may become a matter for the judge to determine, not whether the acts have been done, but whether, upon proof of their having been done, the plaintiff has any case. The mere production of the machine used by the defendant may satisfy the judge that it is entirely different from the plaintiff's, and therefore that there is no evidence of infringement to go to the jury, and such, I think, ought to have been the view taken in this case. The nature of the plaintiff's invention is limited by the disclaimer to the application of centrifugal force by means of a weight acting upon a presser, so as to cause it to press against a bobbin, as described in the specification. Now the weight mentioned in the specification, and shown in the drawing, is not only a substantial but an essential part of the machinery, and the mode of its application may be said to be the very machine itself. But the defendant has no weight at all, in the sense of the plaintiff's specification. The scientific witnesses, indeed, say that the plaintiff's weight is carried up the leg of the flyer to the upper part, or, in other words, that it is placed at the top of the leg of the flyer, and that the defendant's weight is carried a little more than half way up the leg; but this application of the term "weight" to the defendant's machine is really only an ingenious mode of establishing its resemblance to the plaintiff's. The defen-

dant has no weight, properly so called, to carry up or down the leg of the flyer, but he uses a vertical rod, consisting of a solid piece of metal, on the leg of the flyer, which of itself constitutes the means of working the presser, and which is entirely different from the wire with its upper end bent and a small weight attached thereto,—which is the plaintiff's invention. As the plaintiff is, therefore, confined by his disclaimer to the precise machine which he has described, and the machinery of the defendant is not similar to it, though producing the same result, the jury at the trial ought to have been told that there was no evidence of infringement, and the judgement of the Court of Exchequer Chamber is therefore right, and must be affirmed.

Judgment of the Court of Exchequer Chamber affirmed, and appeals dismissed.

PROVISIONAL PROTECTIONS GRANTED.

1860.

[*Cases in which a Full Specification has been deposited.*]

1772. Marc Antoine François Mennons, of Paris, for improvements in the construction and arrangement of marine steam-engines,—being a communication.—[*Dated July 21st.*]

1863. Joseph Roberts, of Old Jewry, for a continuous or ratchet spanner.—[*Dated August 1st.*]

1889. Rudolph Bodmer, of Thavies-inn, for improvements in machinery for converting into down or fibres, capable of being spun, the remnants or cuttings or other waste pieces of silk or other fabrics,—being a communication.—[*Dated August 4th.*]

[*Cases in which a Provisional Specification has been deposited.*]

706. William Newton Wilson, of High Holborn, for improvements in floor sweepers.—[*Dated March 17th.*]

762. John Deane and John Deane, jun., of King William-street, and William Harding, of Forest-hill, for improvements in breech-loading fire-arms,—being partly communications.—[*Dated March 23rd.*]

772. Isaac Blackburn, of Long Eaton, Derbyshire, for improvements in the manufacture of iron and steel, and in making iron castings.—[*Dated March 24th.*]

974. John Fowler, jun., of Cornhill, William Worby, of Ipswich, and David Greig, of New-cross, for improvements in tilling land and in actuating agricultural implements by steam power, and in apparatus employed therein,—being partly a communication.—[*Dated April 18th.*]

1044. Jean Claude Durand, of Brydges-street, Covent-garden, for a new system of drainage for towns when affected by the tide.—[*Dated April 26th.*]

1136. William Mc Donald, of the Hyde-park Barracks, Corporal in Her Majesty's 2nd Life Guards, for improvements in military saddles, and in stirrup-irons to be used therewith.—[*Dated May 8th.*]

1355. Thomas Frederick Newell, of Cloak-lane, Cheapside, for improvements in punching the leaves of cheque and other books and other papers,—being a communication.—[*Dated June 1st.*]

1364. William Taylor, of Nursling, near Southampton, for an improved hand light or portable green-house, to be used for growing and protecting plants, either with or without artificial heat,—[*Dated June 4th.*]

1372. John Mabson, of Sheffield, for improvements, in metal life-buoys, also adapted for holding water or other liquids.—[*Dated June 5th.*]

1388. Charles Stevens, of Welbeck-street, for an improved mode of preparing various plants to be used in the manufacture of paper,—being a communication,—[*Dated June 6th.*]

1458. Bartolommeo Predavalle, of Bloomsbury-street, for a new mode of, and apparatus for, producing and obtaining motive power.—[*Dated June 15th.*]

1490. Anton Verwey, of St. Augustine-

road, Camden Town, for improvements in the proportions of ingredients and mode of manufacture of a chemical compound for softening water.—[*Dated June 20th.*]

1516. Henry Palmer, of Wakefield-terrace, Caledonian-road, Islington, and Henry Spink Swift, of Langbourn Chambers, Fenchurch-street, for improvements in the method of, and apparatus for, propelling ships, vessels, boats, or other craft, in, on, or through the water.—[*Dated June 22nd.*]

1554. John Fletcher, of Farnham-place, Southwark, for improvements in the apparatus for treating saccharine and saline solutions.—[*Dated June 26th.*]

1564. Christopher Binks, of Parliament-street, Westminster, for improvements in manufacturing chlorine.—

1571. William Clark, of Chancery-lane, for improvements in machinery for cutting files,—being a communication.

The above bear date June 28th.

1586. Richard Laming, of Clifton-villas, Maida-hill, and Charles Smith, of Gloucester-street, Regent's-park, for improvements in purifying certain gases and liquids from sulphuretted hydrogen.—[*Dated June 30th.*]

1590. Edward Thomas Hughes, of Chancery-lane, for obtaining coloring matter from the lentisc or mastic tree,—being a communication.—[*Dated July 2nd.*]

1620. John Savage, of Nottingham, for an improved means of, or apparatus for, threading needles.—[*Dated July 4th.*]

1624. Thomas Walker, of Peckham, for an improved collapse detector pocket, for protecting articles worn on the person.

1626. Serge Krotkoff, of Welbeck-street, for improvements in apparatus for employing the electric light.

1630. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved construction of spring-butt hinge,—being a communication.

1631. William Frederick Thomas, of Newgate-street, for improvements in sewing machines.

1632. Joseph Noone, of Peterboro', U.S.A., for a new and useful improvement in the carding machine,—being a communication.

The above bear date July 5th.

1633. Benjamin Lambert, of Warner-street, Dover-road, for improvements in treating printed paper, to remove the ink and to obtain pulp, and also in treating printers' rags, to remove the ink therefrom.

1634. Weston Grimshaw, of Lower Broughton, near Manchester, for certain improvements in machinery for compressing brick earth, and other materials.

1635. Joseph De Maegt, of St. Josse-ten-Noode, near Brussels, for improvements in the manufacture of paper.

1636. Benjamin Mitchell, of Denver, Norfolk, for an improved machine applicable for harrowing, weeding, hoeing, and other agricultural purposes.

1637. Edward Thomas Hughes, of Chancery-lane, for improvements in machinery or apparatus for pressing and ironing, applicable to clothing, bookbinding, and other purposes,—being a communication.

1638. Emil Biedermann, of Rockingham-row, New Kent-road, for improvements in apparatus for the measurement of gas and other fluids.

1639. Thomas Doublet, of City-road, for improvements in rifles and other fire-arms.

The above bear date July 6th.

1640. John Leslie, of Conduit-street, Hanover-square, for improvements in the manufacture of gas.

1641. Jonathan Bircumshaw, of New Lenton, Nottinghamshire, for improvements in machinery for the manufacture of warp fabrics.

1642. Everett Austin Snuggs and John Snuggs, both of New Windsor, for improvements in the manufacture of tea kettles, fountains, coffee-pots, cans, saucepans, stewpans, pails, and other articles of a similar character for domestic use; and baths, watering-pots, and other articles of a similar description.

1643. James Newman, of Birmingham, for improvements in the manufacture

of hooks and other similar dress-fastenings.

The above bear date July 7th.

1644. Richard Pollit, of Bolton-le-Moors, for certain improvements in the construction of steam-boilers.

1645. John Ingham Taylor, of Tuck's-gardens, Sloane-street, and George Butler, of Carlton-street, Kentish-town, for improvements in apparatus for stamping, printing, and embossing.

1646. Léopold Christian Warneck, of Nantes, France, for an improved method of treating the coffee husk for purposes of nutrition.

1647. Joseph Townsend and James Walker, both of Glasgow, for improvements in obtaining sulphur, sulphite, and hyposulphite of lime, and oxide of manganese, from bye or waste chemical products.

1648. Henry Disston, of Philadelphia, U.S.A., for improvements in hand saws.

1649. George Feddis Forbes, of Inverness, for improvements in machinery or apparatus for cleaning cotton.

1650. Jacques Clémille Malfille, of Bordeaux, for an improved elastic band for sustaining and tightening pantaloons, and waistcoats, drawers, petticoats, or other dresses.

1651. Richard Archibald Brooman, of Fleet-street, for improvements in railway brakes,—a communication.

1652. Floride Heindryckx, of Brussels, for improvements in the construction of the permanent way of railways.

1653. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the construction of portable ovens,—being a communication.

1654. William Harper Pritchard, of St. Luke's parish, for an improved apparatus for amusing and exercising children, and assisting them in learning to walk.

The above bear date July 9th.

1655. Robert Wilson, of Glasgow, for improvements in the finishing and folding of textile fabrics.

1656. Thomas Powditch Jordeson, of Eastcheap, for improvements in life boats.

1657. Marc Antoine François Mennons, of Paris, for an improved steam-boiler,—being a communication.

1658. Marc Antoine François Mennons, of Paris, for improvements in the construction and arrangement of apparatus for obtaining motive power from heated compressed air,—being a communication.

1659. Alfred Green and William Henry Glover, of Stourbridge, for an improvement in water tuyeres.

1660. Ferdinand Charles Warlich, of London-street, Fenchurch-street, for improvements in the manufacture of artificial coal fuel, and in apparatus employed in such manufacture.

1661. Swiatoslar Zoubtchaninoff, of Paris, for a cement to prevent the leaking of all liquids, and also dampness in buildings.

1662. Swiatoslar Zoubtchaninoff, of Paris, for an improved compound for the coating of wooden ships, boats, and other structures used at sea.—

1664. George Speight, of Woodbridge-street, Clerkenwell, for an improved means of protecting watches and other small portable articles from being stolen from the person.

The above bear date July 10th.

1665. Eugène Franquinet, of Augrée, Belgium, for improvements in the machinery or apparatus for rolling iron.

1666. William Kemble Hall, of Cannon-street, for improvements in gas regulators.—being a communication.

1667. Thomas Trotman, of Crimscot-street, Bermondsey, for an improved dress fastening.

1668. William Clark, of Chancery-lane, for improvements in steam-engines,—being a communication.

1669. Robert Walker, of Glasgow, for improvements applicable to horse bits.

1670. George Davies, of Serle-street, for improved apparatus for supplying steam-boilers with water,—being a communication.

1671. Arthur Smith, of Glasgow, for improvements in the material for sizing or dressing yarns, preparatory to weaving.

1672. John Webster, of Leicester, for improvements in the construction of circular knitting machinery.

1673. John Davis, of Cinderford, Gloucestershire, for improvements in apparatus for the prevention of accidents at mines or pits.

1674. James Jack, of Liverpool, for improvements in the construction and arrangement of surface condensers for marine and land steam-engines.
1675. Samuel Povah, of Liverpool, for an improved combined portable steam-engine winch, and apparatus or machinery for operating the pumps and parts of the rigging, warping, raising the anchor, and for other uses on board ships, where power is required; parts of the same being applicable for like uses separately.
1676. Paul Pizzi, of Winsley-street, for improvements in preparing and treating the surfaces of the interiors and exteriors of houses, edifices, monuments, and other buildings, to imitate polished marble or stone; also rendering them impervious to the action of the atmosphere and other elements.

The above bear date July 11*th.*

1677. Joseph Gibbs, of Brentford, for improvements in constructing submerged works.
1678. Edward Thomas Hughes, of Chancery-lane, for improvements in shrouds or winding sheets,—being a communication.
1679. John Askew, of Charles-street, Hampstead-road, for improvements in window-sashes.
1680. Thomas Brearley, of Dock-street, Whitechapel, for improvements in machinery for producing and revivifying animal charcoal.
1681. Peter Graham, of Oxford-street, for improvements in means or apparatus for operating roller blinds.
1682. Henry Shaw, of Dublin, for improvements in means or apparatus for stopping railway trains.
1683. Frederick Ayckbourn, of Mitcham-common, for improvements in tubular beds and bolsters.
1684. Frederick Osbourn, of Aldersgate-street, for improvements in the construction of endless saws and cutters.
1685. Francis Mordan, of Goswell-road, for improvements in bottles, jars, or vessels for holding blacking, and in certain appurtenances thereof; part of the invention being applicable to stoppers for bottles used for other purposes.
1686. John Ferguson, of Glasgow, for improvements in machinery or apparatus for sawing or cutting wood into veneers and planks,—being a communication.

The above bear date July 12*th.*

1687. Perceval Moses Parsons, of Arthur-street West, for improvements in ordnance and firearms, and in tools for rifling the same.
1688. John William Edge, of Manchester, for improvements in rifled fire-arms, guns, and ordnance.
1689. Marie Virginie Boquet, of Paris, for canisters or vessels, fitted moveable and hermetically stopping covers, for containing preserved alimentary or other substances.
1690. Charles Tiot Judkins, of Ludgate-street, for improvements in sewing machines,—being partly a communication.
1691. Francis Joseph Risse, of Great Bland-street, Southwark, for improvements in gun-locks.
1692. Francis Joseph Risse, of Great Bland-street, Southwark, for improvements in pressure gauges.
1693. George Anderson, of Leadenhall-street, for improvements in singeing pigs, and in apparatus for the same.
1694. Andrew Strathern, Andrew Strathern the younger, and Allan Strathern, all of Glasgow, for improvements in stop-cocks, or valves for regulating the flow of fluids.
1695. Charles Grey Hill, of Nottingham, for improvements in machinery for the manufacture of bonnet fronts, rouches, and other millinery trimmings, or for other purposes.
1696. William Allen, of Nottingham, and William Allen, of Carrington, Nottinghamshire, for improvements in the prevention of incrustation and corrosion of steam-engine boilers.
1697. Michael Henry, of Fleet-street, for improvements in looms, and in the jacquard apparatus of looms,—being a communication.

The above bear date July 13*th.*

1698. William Bragge, of Sheffield, for improvements in the manufacture of tyres for railway wheels.
1699. John Pile and John Robert Smyth, both of West Hartlepool, for improvements in the preservation of iron surfaces from corrosion or decay.

1700. Henry George Austin, of Canterbury, for improved apparatus for propelling vessels.

1702. Thomas William Miller, of Her Majesty's Dockyard, Portsmouth, for improvements in the construction of tubular boilers or steam generators, and surface condensers, and such like apparatus, and in the method of forming, applying, fitting, and using, metal tubes for the same.

1703. Joseph and Samuel Lingford, both of Bishop Auckland, Durham, for an improved machine for washing, drying, and dressing currants.

1704. Albrecht de Neviers, of New Cremorne-road, Chelsea, for improvements in breech-loading firearms.

1705. Samuel Tom Cornish, of Beaumont-square, Mile End-road, for improvements in ships' closets.

1706. Jean Mechim, of Croydon, for improvements in pianos and organs. —being a communication.

1707. Maximilian Louis Joseph Chollet, of Paris, for a solid alimentary compound for making soups, seasoning meats, made dishes, and vegetables.

1708. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improved manufacture of waterproof leather,—being a communication.

1709. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the construction of windlasses,—being a communication.

1710. Lewis Hope, of Bishopsgate-churchyard, for improvements in knot-stitch sewing machines.

The above bear date July 14th.

1711. William Frederick Henson, of New Cavendish-street, Portland-place, for improvements in railway carriage buffer and other springs.

1712. Frederick Ludewig Hahn Danchell, of Great Queen-street, Westminster, for certain improvements in filters.

1713. Samuel Ivers, of Halshaw Moor, and Mark Smith, of Heywood, both in Lancashire, for improvements in machinery for communicating motion to and for stopping looms for weaving.

1714. Alfred Smith, of Manchester, for certain improvements in the manufacture of velvet or other similar piled fabrics.

1715. Samuel Baldwyn Rogers, of Newport, Monmouthshire, for an improvement in the smelting of iron ores.

1716. William Bauer, of Munich, for an improved diving bell.

1717. William Bauer, of Munich, for a new method of laying down and raising, or cutting off for repairing and other purposes, of telegraph cables, chains, or ropes.

1718. Alexander Bain, of Clerkenwell-green, for improvements in means, apparatus, or articles for holding and supplying ink.

1719. Richard Archibald Brooman, of Fleet-street, for an improved clip for holding tickets and other articles,—being a communication.

1720. William Birks, the elder, and William Birks, the younger, both of Nottingham, for improvements in bobbin-net or twist-lace machinery.

1721. Joseph Thiébaut, of Whitechapel, for improvements in the ornamentation of textile fabrics.

The above bear date July 16th.

1722. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improved covering for roofs and walls,—being a communication.

The above bear date July 16th.

1723. Henry Gloag, of Edinburgh, for improvements in breech-loading firearms and cannons.

1724. Charles Stevens, of Welbeck-street, Cavendish-square, for an improved method of preserving potatoes cut in pieces by a machine for that purpose,—being a communication.

1725. James Henson, of Watford, Herts, and William Frederick Henson, of New Cavendish-street, Portland-place, for manufacturing canvas and other fabrics for tarpaulings, sacks, rick-cloths, ship sails, and for other purposes, and also for uniting the edges of the same.

1726. James Fletcher, of Accrington, Lancashire, for improvements in machinery or apparatus for regulating the supply and discharge of fluids to steam-boilers, pipes, and other vessels, and for cleansing or cleaning the same.

1727. Leopold Unger, of Bonn, Prussia, for improvements in the construction and arrangement of box-irons, used by laundresses and others for pressing and smoothing clothes and fabrics.
1728. Francis Charles Seyde, of Warren-street, Fitzroy-square, for improved mechanism for pulping, triturating, and comminuting for culinary and other purposes.
1729. George Spencer, of Cannon-street West, for improvements in the means or apparatus used for lubricating valves and pistons, and other portions of locomotives and other engines worked by steam, air, gas, or vapour,—being a communication.
1730. Adam Carlyle Bamlett, of Myddelton Tyas, Yorkshire, for improvements in reaping and mowing machines.
1731. Edward Loysel, of Cannon-street, for improvements in locks or fastenings,—being a communication.
1732. Abraham Eskell, of Grosvenor-street, Grosvenor-square, for improvements in beds or bases for artificial teeth.
1733. Philip Vallance, of Bolton-road, St. John's-wood, for improvements in the construction of telescopic sights for rifles and other fire-arms and ordnance.
1734. Job Goulson, of Ponsonby-terrace, Vauxhall-bridge-road, for improvements in gas and other fluid meters.

The above bear date July 17th.

1735. Donald Skekel, of Demerara, for improvements in pistons for steam-engine and other cylinders; which improvements are also applicable to the buckets of pumps,—being a communication.
1736. John Picksley and Reuben Sims, both of Bedford Foundry, near Leigh, Lancashire, for improvements in bone mills and logwood rasps.
1737. Prosper Verdat du Trembley and André Desiré Martin, of Rouen, for improvements in brake-apparatus, suited for railway carriages and for other purposes.
1738. Thomas Carey Willard Pierce, and George Frederick Stanley Isherwood, both of Manchester, for certain improvements in power looms for weaving.
1739. Thomas Gray, of Bride-lane, for improvements in the manufacture of flock, such as is employed for flocking paper hangings, and for other purposes.
1740. Robert Oxland, of Plymouth, for improvements in the manufacture of gunpowder.
1741. Samuel Pim Jackson and Albert Jackson, both of Bristol, for improvements in the manufacture of window-sashes, casements, and other frames suitable for glazing.
1743. James Hunt, of Birmingham, for certain improvements in hair-triggers, or detents for single or double-barrelled guns or pistols.
1744. John Henry Johnson, of Lincoln's-inn-fields, for coloring matter, and the means of obtaining the same,—being a communication.
1745. Charles Stevens, of Welbeck-street, for an improved screw-cutting machine,—being a communication.

The above bear date July 18th.

1746. Henry Holland, of Birmingham, for an improvement in the manufacture of steel tubular stretchers for umbrellas and parasols.
1747. Isaac Broad Shaw, of Tunstall, and James Edmund Shaw, of Burslem, both in Staffordshire, for improvements in the ornamentation or decoration of earthenware, porcelain, glass, and other articles, and in producing the designs, figures, patterns, and roller moulds, used in such process; such roller moulds being also applicable for the casting of rollers used in typographic and lithographic printing.
1748. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the manufacture or production of white lead, and in the machinery or apparatus employed therein,—being a communication.
1749. Isaac Noah Davis, of Brentford, for producing spirit from rice, maize, barley, or other grain,—being a communication.
1750. Alonzo Buonaparte Woodcock, of Manchester, for improvements in the manufacture of moulded articles of vulcanized india-rubber.
1751. William Barrett, of Norton, near Stockton-on-Tees, for improvements in machinery to be used when casting metals.

1752. John Stenhouse, of Upper Brunswick-terrace, Barnsbury-road, for improvements in purifying coal-gas.

1753. Timothy Tyrrell, of Guildhall-yard, for improvements in the construction of tubular boilers.

1754. John Saxby, of Brighton, for improvements in apparatus for, and in the mode or method of, working and governing railway points and signals.

1755. William Clark, of Chancery-lane, for improvements in valve apparatus for regulating the flow of steam and other fluids,—being a communication.

1756. William Clark, of Chancery-lane, for improvements in stamping or embossing presses,—being a communication.

The above bear date July 19th.

1757. Charles Wenzel Hähnel, of Manchester, for improvements in the construction of parts of umbrellas and parasols,—a communication.

1758. Joseph Dickinson, of Pendleton, near Manchester, for improvements in machinery for retarding or stopping railway or other carriages, and for other purposes where breaks are applicable.

1759. John Broad, of Ulverston, Lancashire, for an apparatus for economizing coal and other fuel, to be used with hot or cold blast, in the smelting of iron ores and re-smelting of pig iron.

1760. Robert Pinkney, of Bread-street-hill, for an improved pencilcase.

1761. John Kenny, of Litchfield-street, Soho, for improvements in sewing machines.

1763. Henry William Poulter, of Thayer-street, Manchester-square, for improvements in the arrangement and construction of printers' composing cases, and in the frames used therewith.

1764. Charles Constant Joseph Guffroy, of Lille, for improvements in preparing the livers of salt-water fish,—being a communication.

1765. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the manufacture of apparatus for regulating the force of electric currents,—being a communication.

1766. Caleb Bedells, of Leicester, for improvements in the manufacture of braces.

The above bear date July 20th.

1767. William Lake, of the Old Kent-road, for an improved button or fastening for iron bedsteads and other purposes.

1768. Ebenezer Hollis, of Birmingham, for certain improvements in muzzle-loading guns, applicable for military and sporting purposes; parts of which are also applicable to certain descriptions of pistols and breech-loading guns, as also in the manner of fixing or connecting bayonets to military guns.

1769. James Hadden Young, of Great College-street, Camden Town, for improvements in setting-up (composing) and distributing type.

1771. Samuel Roberts, of Hull, for improvements in harrows.

1773. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in looms for weaving,—being a communication.

1774. Alphonse René Le Mire Normandy, of King's-road, Clapham-park, for improvements in connecting gas and other pipes.

The above bear date July 21st.

1775. Richard Hewens, of Leamington, Warwickshire, for an improvement in kitchen ranges, which is also applicable to stoves in general.

1776. Henry Green, of Bolton-le-Moors, for improvements in charging and drawing the charge from gas retorts, and in the machinery employed in performing such operations.

1777. Jean Baptiste Jules Noirot, of Paris, for an improved method of manufacturing india-rubber tubes and various articles.

1779. George Henry Birkbeck, of Southampton-buildings, Chancery-lane, for improvements in the construction of chimneys for lamps, or apparatus for transmitting light,—being a communication.

1780. Archibald Turner, of Leicester, for improvements in the manufacture of elastic fabrics.

1781. John Wells Sullivan, of Adam-street, Adelphi, for improved machinery applicable to washing and

churning, and the mixing of fluids, —being a communication.

The above bear date July 23rd.

1782. Henry Jones, of Neath, Glamorganshire, for improvements in rails for railways.

1783. William Clark, of Chancery-lane, for improvements in apparatus for setting and sharpening scythes and other like instruments,—being a communication.

1784. Andrew Robertson, of Neilston, Renfrewshire, and Alexander Ritchie, of Glasgow, for improvements in steam-boiler and other furnaces or fire-places, in pyrometers, and in tne prevention of smoke.

1785. Lewis Le Richeux, of Sussex-road, Brixton, for improvements in the means of attaching buttons or studs to articles of clothing or other similar articles, and in the buttons or studs to be adapted thereto.

1787. Hermann Hirsch, of Berlin, for improvements in screw-propellers.

1788. Louis Cyrus Macaire, of Paris, for a substitute for nitrate of silver; particularly applicable to photographic purposes.

1789. Rebecca Thomas, of Bath-street, Tabernacle-square, for improvements in the tyres of wheels for vehicles used on common roads.

1790. William Brunner, of Printing-house-square, and William Hall, Levett, of Clare-street, Lincoln's-inn-fields. for an improved apparatus for increasing the illuminating power of coal gas; also for economizing the consumption thereof, and for regulating the pressure from street mains.

1791. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved means for relieving the slide-valves of steam-engines of unnecessary pressure,—being a communication.

1792. Robert Alexander Rumble, of Trinity-square, Southwark, for improved apparatus for feeding fuel to fireplaces or furnaces.

1793. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improved mathematical or plotting instrument, which he intends to denominate a protracting trigonometer,—being a communication.

1794. Sir Peter Fairbairn, Knight, and Joseph Barrow, both of Leeds, for an improvement in the construction of self-acting lathes,

The above bear date July 24th.

1795. William Edward Taylor, of Enfield, near Accrington, for certain improvements in looms for weaving.

1796. Eugène Hédou, of Paris, for improvements in the manufacture of tar paper; which improvements may also be applied to several other uses.

1797. Montague Richard Leverson, of St. Helen's-place, for improvements in applying springs to locomotive engines; and to railway and other carriages,—being a communication.

1799. Marc Antoine François Mennons, of Paris, for improvements in the processes of, and apparatus for, unwinding silk from cocoons,—being a communication.

1800. Marc Antoine François Mennons, of Paris, for improvements in etching on zinc,—being a communication.

1801. Samuel James Wilkinson and George Frederick Lee Meakin, both of St. Mary Axe, for improvements in the construction of boxes, trunks, or packing cases, to be called the 'plicabilis,' or folding box, trunk, or packing case.

1802. Thomas Hartley, of Bury, Lancashire, for an improved fibrous material for manufacturing woven fabrics.

1803. John Pilkington, of Fish-street-hill, for improvements in means for protecting and making water-tight exposed surfaces, such as railway arches, bridges, roofs, and other structures.

1804. Henry Clarke Ash, of Claylands-terrace, Clapham-road, for improvements in apparatus employed in cooling and freezing liquids.

1805. Charles William Lancaster, of New Bond-street, and James Brown and John Hughes, both of Newport, Monmouthshire, for improvements in the manufacture of plates for coating or covering and strengthening ships and other structures, and in fixing the same.

1806. Jules Léonard Louis Cambacérès, of Paris, for certain improvements in treating fatty and oily matters.

1807. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane,

for an improvement in the process of concentrating and cyrstallizing sugar,—being a communication.

1808. William Rose, of Hales Owen, Worcestershire, for improvements in breech-loading firearms and ordnance.

1809. Robert Thursfield Smith and Thomas Suckley, both of Whitchurch, Salop, for improved apparatus for smutting and screening grain, and distributing other granular substances.

1811. Leonard Kaberry, of Rochdale, Lancashire, for improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous materials.

The above bear date July 25th.

1812. Thoms Marshall Downing, of Handsworth, Staffordshire, for certain improvements in tanks, vats, or vessels, to be used for holding, keeping, or storing, of malt liquors, wines, spirits, and other liquids for human consumption.

1813. Joseph Thompson, of Sheffield, for an improvement in covers for jugs; also applicable to covers for other articles.

1814. Michael Henry, of Fleet-street, for improvements in engines for obtaining motive power,—being a communication.

1815. Gaetano Bonelli, of Milan, for improvements in the manufacture of felted fabrics and paper,—being a communication.

1816. Amédée Gélis, of Paris, for improvements in preparing compounds of cyanogen, and principally of prussiates, by means of sulphuretted carbamids or amids, which supply sulphurets of carbon by their decomposition.

The above bear date July 26th.

1817. William Campbell, of Hollinshead Hall, Chorley, Lancashire, for improvements in the form of steam ships.

1819. Charles Armand Grossetete, of Cranbourn-street, Leicester-square, for an improved reversed conical non-swerving spring mattress.

The above bear date July 27th.

NEW PATENTS SEALED.

1859.

2762. W. E. Newton.

1860.

59. Robert Mathers.
170. John Appleby.
195. J. P. Lamar.
202. T. W. Plum.
219. James Lord.
220. C. N. Nixon.
226. Julius Jeffreys.
227. T. B. Daft.
229. Eugen Langen.
232. Thomas Walker.
233. H. Hodgson and P. M. Crane.
241. Benjamin Matthewman.
242. G. A. Cator.
246. George Smith.
247. Leonard Appleton.
249. Thomas Smith.
251. George Owen.
252. Thomas Culpin.
253. R. A. Brooman.
255. R. J. Cole.
256. Ferdinand Jossa.
259. Benjamin Shaw.
260. Joseph Ambler.
269. J. L. Brethon.
274. Thomas Routledge.
275. Samuel Chatwood.
279. L. P. Barré.
282. W. Howes and W. Burley.
286. R. and T. Fielden.
293. J. G. Willans.
295. Andrew Kerr.
296. J. G. Dahlke.
297. E. W. Uren.
298. Patrick Robertson.
299. G. A. Biddell.
301. C. T. Launay and A. M. A. D. de Vernez.
302. C. T. Launay and A. M. A. Dominé de Vernez.
308. John Smith.
309. John Smith.
310. J. E. Boyd.
311. Joseph Skertchly.
317. T. Tye and C. W. Andrew.
322. Paul Chartroule.
323. H. C. Jennings.
324. A. L. E. Breittmayer.
327. Collinson Hall.
329. Edmund Lea.
330. Alexander Dalgety.
332. J. M. Rowan and T. R. Horton.
338. George Whight.

341. J. E. Durand.
345. J. Langford and C. Chester.
346. James Carver.
349. J. C. Lupton and J. Bleasdale.
351. W. A. Gilbee.
352. H. Deacon and T. Robinson.
354. George White.
356. T. W. Rammell.
357. Patrick Adie.
368. David Dietz.
373. Thomas Shedden.
376. Benjamin Purnell.
378. Edward Humphrys.
379. W. Milton and J. Penney.
380. William Harwood.
381. R. J. Cole.
384. J. C. Haddan.
387. Edouard Landsberg, aîné.
388. J. A. H. Ballande.
389. Thomas Shedden.
390. R. J. Cole.
391. John Marsh.
394. William Clark.
395. L. J. T. Howard and L. Howard.
396. Samuel Copping.
398. J. Leach and T. Clayton.
399. William Leatham.
401. William Hunter.
405. William Davis.
408. S. Rowbotham and G. H. Bolton.
412. James Ronald.
413. George Whight.
415. Thomas Allen.
417. Gaetano Bonelli.
418. John Hamilton.
422. Thomas Green.
423. George Parsons.
425. George Cowdery.
426. William Clark.
435. Alfred Belpaire.
436. Samuel Bury.
440. H. D. P. Cunningham.
441. William Woodcock.
442. David Irons.
444. J. Maude and L. Tindall.
446. P. A. Gillis.
447. P. E. S. Dulos.
450. John Sanders.
451. Michael Henry.
457. Alexander Teissière.
459. Thomas Hoyle.
461. F. W. Mart.
463. R. A. Brooman.
464. G. W. Townsend.
465. Sir C. T. Bright.
467. P. J. Weerts.
475. Christian Schiele.
476. W. E. Newton.
477. V. E. Lecoupeur.
484. J. H. Tuck.
488. William Haynes.
489. W. and H. Charlesworth and T. H. Dunbar.
497. François Boissau.
504. R. A. Brooman.
506. Seth Ward.
507. J. H. Johnson.
512. Thomas North.
513. John Lightfoot.
514. E. T. Hughes.
515. B. Armable and J. Blench.
516. James and John Gillespie.
519. C. W. Siemens.
521. T. Lambert and O. Wakefield.
522. George Jenkins.
523. J. E. Boyd.
530. C. F. J. Fonrobert.
531. Johann Faber.
535. R. B. Cooley.
542. Robert Walker.
569. William Clark.
597. John Sidebottom.
600. J. H. Johnson.
605. James Howard.
606. W. E. Newton.
608. Thomas Cox, jun., & W. Holland.
618. W. R. Jeune.
638. J. Lister and J. Lees.
643. William Clay.
671. W. E. Newton.
679. J. H. Johnson.
683. A. V. Newton.
707. E. and W. Cope and W. G. Ward.
753. Isidore Hayem.
767. W. E. Newton.
773. J. H. Johnson.
778. J. A. Maxwell.
817. John Hamilton, jun.
881. William Clark.
882. William Clark.
904. T. A. Turner.
956. Albert Accarain.
1007. John Harvey.
1083. Henry Rawson.
1088. G. T. Bousfield.
1090. Hiram Hutchinson.
1183. W. H. Muntz and H. King.
1215. M. A. F. Mennons.
1224. Hezekiah Conant.
1251. W. E. Newton.
1262. James Hickisson.
1264. John Paton.
1304. G. D. Jones.
1320. Thomas Cullick.
1349. Richard Threlfall.
1352. T. Greenwood and John Batley.
1380. George Bower.
1410. Gregory Kane.
1467. John Moule.
1581. C. J. N. Rebour.

*** *For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

iling wool.

Fig: 1.

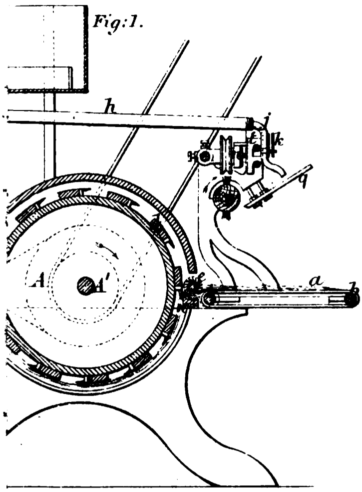
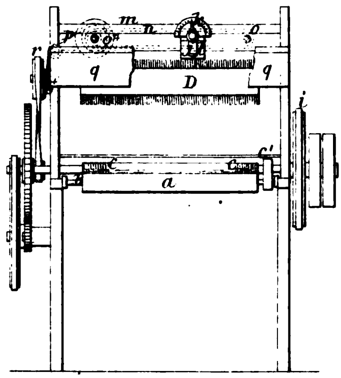
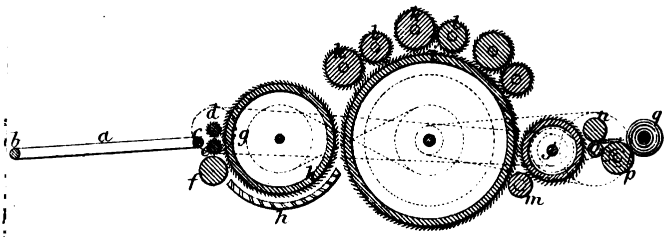


Fig: 2.



Holden's carding.



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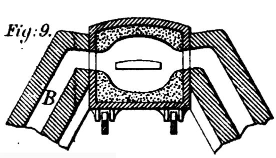
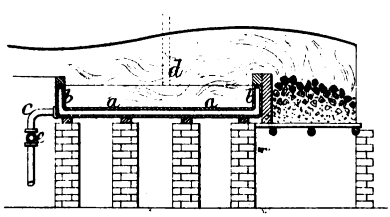


Bedson's puddling furnace.



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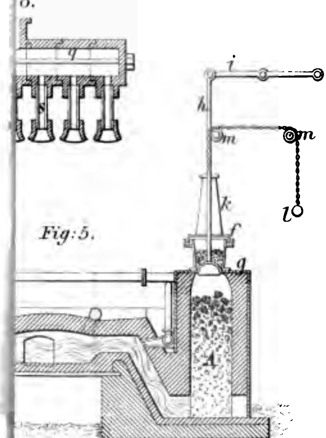


Fig: 5.

Bolton & othrs spinning.

Fig: 1.

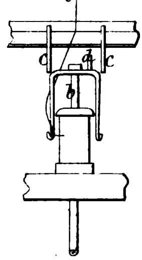
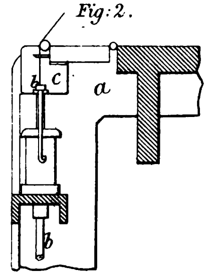
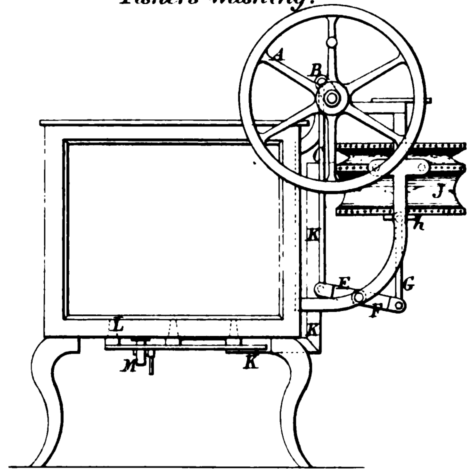
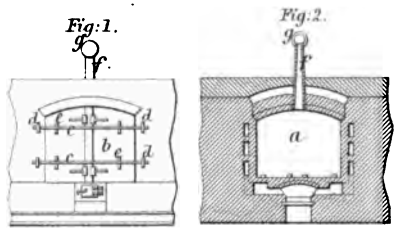


Fig: 2.

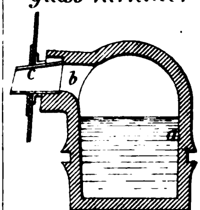


Fisher's washing.

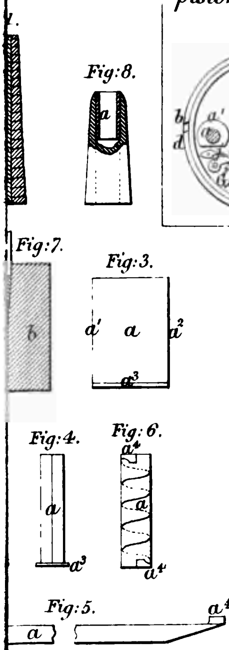




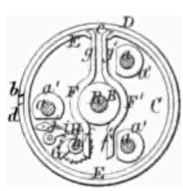
Chance & Howell's glass furnace.



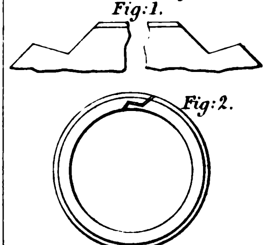
...s cop tubes.



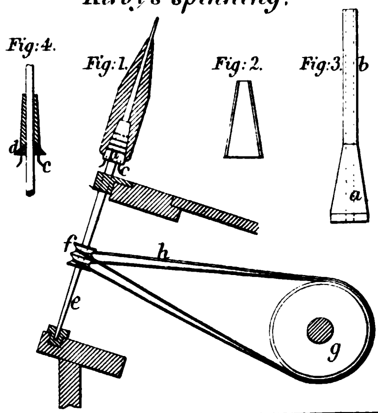
Newton's piston packing.



Plum's wheel tyres.



Kirby's spinning.



C. Pilling, lith.

NEWTON'S
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SOCIAL REFORMS OF THE PAST SESSION.

However reasonable may be the disappointment created in the public mind by the foundering of the many important Government measures of social reform, announced at the commencement of the last session as ripe for enactment, it is satisfactory to know that substantial progress has nevertheless been made in this branch of legislation, though in a quiet and unostentatious way. Since the Act passed in the year 1857, "to make better provision for the punishment of frauds committed by trustees, bankers, and other persons intrusted with property," no step so calculated to check the fever of dishonesty has been taken, as the passing of the Act of last session (cap. 84), "for preventing the adulteration of articles of food and drink." It will be remembered that the first mentioned Act was called for by reason of the astounding revelations of fraud, which, about the year 1857, threw discredit on the highest classes in the mercantile community. To vindicate the character of the country, and, if possible, to secure trust-worthiness where confidence must necessarily be imposed, was the object of the legislature, in the enactment of this law; but now we have another, which is intended to touch a more extended class, and to remove from manufacturers of, and traders in, edible substances, those inducements to dishonesty which have in too many instances proved irresistible. When dealing with the fraudulent disposal of property by bankers and trustees, the legislature had a very simple course to pursue, inasmuch as actions, admitted on all hands to be morally dishonest, had merely to be declared legally so; but, in the matter of adulterations, many difficulties had to be weighed and carefully avoided. The recent legislation on this subject cannot, however, be deemed over hasty, for it is based on the labours of a select Committee of the House of Commons, which sat during the sessions of 1855 and 1856, to hear evidence and report upon the advisability of amending the laws relating to the adulterations of food. Before this Committee, many of our first analytical chemists were called, and ample evidence was adduced to establish the fact of fresh legislation being required. In their final report, the Committee said, in relation to the then prevailing practice of adulteration, that "not only is the public health exposed to danger, and pecuniary fraud committed on the whole community, but the public morality is tainted, and the

high commercial character of the country lowered both at home and in the eyes of foreign countries. Though, happily, very many refuse, under every temptation, to falsify the quality of their wares, there are, unfortunately, large numbers who, though reluctantly practising deception, yield to the pernicious contagion of example, or to the hard pressure of competition forced upon them by their less scrupulous neighbours." The disclosures of persistent fraud in commercial circles, immediately following the publication of the report, went far to establish the fact of public morality being tainted, and legislative action, resulting in the law for the punishment of fraudulent trustees, &c., was promptly taken to strengthen the hands of justice; but a period of four years was allowed to intervene before a remedial measure, for checking the adulteration of food, was enacted.

Although convinced of the imperative necessity for putting a stop to the adulteration of food, the Committee acknowledged it was no easy task to perform; for, as they truly remarked, "the great difficulty of legislating on this subject lies in putting an end to the liberty of fraud *without affecting the freedom of commerce*." "Adulteration," the report says, "may be classified under three heads:—those of which the object is to lower the price of the article adulterated, by the admixture of substances of a cheaper kind; those which are intended to improve the appearance of the adulterated articles, and thus, in many cases, to deceive the public as to its quality; and those which are practised for the purpose of simulating some property injured or destroyed in the process of adulteration. Adulterations in each of these classes are of two kinds,—those in which are employed substances of an innocuous character, and those in which the mixtures are more or less injurious to health, either directly by the noxious properties of the ingredients, or indirectly by lowering the nutritive qualities of the article adulterated."

The article which formed the chief subject of enquiry by the Committee was naturally bread; attention being mainly directed to the disputed fact of the presence of alum therein, and the effect of that adulteration on the human system. A statement had been made that Professor Liebig had discoverd crystals of alum in bread, and this statement Dr. Carpenter confirmed by his own experience. Other witnesses had given the Committee tests by which the public might satisfy themselves as to the presence or absence of alum, and the daily reception of alum into the system had been shown to be injurious to health, so that here was a case ripe for stringent legislation; but, fortunately, for the sake of truth, the evidence of a gentleman, who, both by his pen in this Journal and as a witness in courts of law, has often done good service to science, was forthcoming. It remained for Mr. Lewis Thompson to demonstrate the

fallacy of the assumption that alum existed or could exist in bread. He had placed crystals of alum in dough, and after baking had found not a vestige of the crystals remaining; the alum having been liquified by the heat and absorbed into the farinaceous particles of the bread. The constituents of alum—sulphuric acid, potash, alumina, and water—he had found in seventy-eight cases which he had examined, but these apart or uncombined did not possess the properties of alum; the assumption then that the public health was seriously affected by the daily consumption of alum, was simply a delusion. This evidence was in part confirmed by Professor Taylor, Mr. Linsey Blyth, Lecturer on Natural Philosophy at St. Mary's Hospital, Paddington, and Dr. Neligan, of Dublin. But Mr. Lewis Thompson's evidence did not rest here; for he showed that there was not only no injurious effect to be apprehended from the properties of alum commonly used, but that it had its advantages. Although used by bakers solely for improving the appearance of the bread, it checked its tendency to become mouldy, made the bread firmer, and, if a medicinal effect were due to the constituents, it would be rather that of a purgative than an astringent. The tests also for alum, given to the Committee, he demonstrated to be fallacious. Here then was evidence on one subject sufficient to instil caution into our legislators before committing themselves to a course which the long series of revelations in the *Lancet* had induced the public to believe was so desirable. With respect to the adulteration of flour, the evidence of Mr. Potts Brown, an extensive miller, offered some new light. On this gentleman's authority, we are informed that the adulteration of flour is necessary, in order to ensure to the public a good wholesome article, and raise the home-grown wheats to an equality with foreign produce. There appears to be great judgment required in the treatment of English wheat, to bring it up to quality; the corn from different parts of the island requiring special treatment. Mr. Potts Brown disclaims the possession of chemical knowledge, but it is evident he is no tyro in the science. He tells the Committee the relative proportions of gluten contained in wheat and in beans, and shows the advantages accruing from the admixture of bean-flour with wheat-meal: he adds one part of bean-flour to from forty to sixty of wheat, according to its quality. By this judicious admixture, he adapts his meal to the necessities of the London bakers, who are, he tells us, good judges of the wheat they are purchasing. The special requirement which Mr. Brown's mixture is intended to meet, and which his extensive dealings proves it has fulfilled, is as follows:—"The flour to produce bread of the following quality: the loaf must be of a white colour and a good weight; the corners free from a doughy skin, the crust not to dry of a brown colour; it must

cut with softness, with a plain surface, and no large holes." Now these are, doubtless, one and all, important advantages. But then, says Mr. Brown, "how are they to be attained if the miller is to be restricted by law from introducing into human food a small per centage of what is known to be so beneficial to horses?" There may be much or nothing in his objection; at any rate, it brings out the nature of the difficulty of "putting an end to the liberty of fraud without affecting the freedom of commerce." To take another example of this witness's skill. We have seen that he improves the better article by the addition of a worse, but we shall also see that he raises the quality of the worse by the addition of the better. Thus, in answer to the question, "You put [together] beans and barley sometimes?" he says, "when I send flour into Northamptonshire, I mix wheat with barley, not barley with wheat.... In dear times they must eat barley, they cannot afford to buy wheat." Here is a case of adulteration to suit the taste of the poor Northamptonshire peasant, without touching his pocket. Mr. Brown adulterates his barley-meal with wheaten flour! Generous patriot! And are such acts as these to be prohibited by law? But then legislation must be adapted for the masses, not for individual exceptions; therefore, it would appear necessary that the admission into wheaten flour of horse beans, although calculated, as Mr. Brown assures us, to "lay on flesh quicker and faster than wheat," should be restricted by law, to prevent its reckless employment in the hands of unskilful or avaricious millers.

The adulteration of beer seemed to present some difficulties to the Committee. It was generally believed, by witnesses examined, that the publicans were guilty of diluting and drugging the beer which they received in a pure state from the brewers. Of those convinced of the use of narcotics and water were, Mr. Blyth, Dr. Challice, Professor Taylor, Dr. Hassall, and Mr. Wickham; the last of whom, having been long engaged in the trade of brewing, gives it as his opinion, that adulteration of beer mainly takes place in the cellar of the publican, and that publicans who do not adulterate form exceptions to the rule; but not one of the analytical chemists examined could speak positively to the use of that pernicious drug cocculus indicus, which has the reputation of forming the chief intoxicating element in London porter. This negative evidence is by no means calculated to dispel the prevailing belief; for while it is beyond doubt, that cocculus indicus is largely imported, and one witness (Mr. Gay, formerly a drug grinder) declared that he had ground it in large quantities, not one of the witnesses—although in the aggregate necessarily familiar with all the chemical manufactures of the country—could point out any trade in which it could be legitimately applied.

Of other alimentary substances of less importance, evidence was adduced to show the harmless character of the adulteration of some, and the injurious properties imparted to others; such adulteration being, in certain instances, to improve the appearance of the article, and in others to deceive. Another class of adulteration, if such the deception could be called, consisted in the substitution of one article for another, to bring the manufacture down to a price that would suit the public wants. An instance of this is given by Professor Taylor, who says, "A large quantity of candles are now manufactured and sold as sperm and wax, which are not sperm and wax. Stearic acid is used: it is an admirable manufacture, and they are excellent candles, but they are sold under a name that does not belong to them; and then, to give them the appearance of wax, they are colored with yellow coloring matter; but unless sold as wax or sperm, they would not meet with a ready market. We get by the stearic candle manufacture excellent candles, at a cheap rate, equal to wax." From this example, and others of a like kind which might be adduced, it will be readily seen that the subject of adulteration is not the most simple to legislate upon.

Besides, however, leaving commerce free and unfettered, it is desirable also, while enacting laws for checking trade frauds, to avoid, as far as possible, opening the door to groundless and malicious prosecutions. Of groundless accusations, the evidence obtained by the Committee affords several striking examples. Dr. Carpenter adverts to the case of Messrs. Fry, of Bristol, charged by Dr. Hassall, through a faulty analysis, with adulterating chicory to a large extent with roasted corn. To prove the groundless nature of the charge, and obtain an acknowledgment of the error, these gentlemen were put to the expense of £120 for chemical analyses, besides the outlay in legal proceedings. Mr. Lewis Thompson also refers to a case, in which he was associated with the late Dr. Ure, arising out of a statement in the *Lancet*, that Messrs. Hall and Evans, of Worcester, vinegar manufacturers, had adulterated their vinegar with oil of vitrol. He says, "I examined their works. They are very large vinegar manufacturers; and I made a calculation from the quantity of oil of vitriol, as it was called, which had been found in their vinegar, that taking the whole quantity of vinegar they produced, it would require something like 25 carboys of oil of vitrol a week to produce the adulteration in question. It would be quite impossible, of course, to have brought anything of that kind into the manufactory without every one seeing it. I found there was not a particle of oil of vitriol on the works. In examining the water of which the vinegar was made, I found it contained an enormous quantity of sulphate of lime. I have no doubt the mode adopted for testing the vinegar was by salts of baryta, and that the sulphuric acid combined

with the lime had been taken to be oil of vitriol. I examined the whole of the vinegar belonging to the establishment, and I examined a great many samples from their warehouse in London, and there was no oil of vitriol in any of them." In one instance, an aggrieved tradesman appeared in person before the Committee, to state the wrongs he had suffered from a false accusation in the *Lancet.* He had followed the calling of a baker, and had been accused of adulterating his bread with alum: to the publication of this accusation, he attributed his compulsion to retire from business, for he could not reinstate himself in the good opinion of his customers by an action at law, owing to Mr. Wakley refusing to part with a portion of the bread that had been analysed. In the evidence of Dr. Bingley, the facts of a case were stated, in which Mr. Crossby, of Rotherham, appeared as an undeserved sufferer. His flour had been seized, and found to contain as much as four per cent. of gypsum, and he was convicted for the offence. Having appealed against the decision, facts came to light which showed that the flour had been tampered with subsequently to its leaving Mr. Crossby's hands, and in so clumsy a manner, that, according to Dr. Odling (also concerned in the investigation), "large quantities of gypsum could have been picked out of his sample, and were apparent to the naked eye." From this case of Mr. Crossby's, Dr. Bingley concluded that "there are not sufficient statutory provisions to check or protect the accused party in case of information. There ought," he continues, "to be some means of having samples of suspected articles properly sealed up in the presence of indifferent parties, who may have means or opportunities afforded them to analyse them."

To provide a ready and sure means of convicting and punishing persons knowingly selling adulterated articles, at the same time leaving commerce unfettered, and rendering groundless and malicious prosecutions next to impossible, is therefore the aim of the Act of the last session, and this, we think, it has accomplished. Thus, it is enacted, that any person selling any article of food or drink which, to the knowledge of the seller contains any ingredient injurious to the health of the consumer, as also any person selling as pure or unadulterated any article of food or drink which is adulterated, shall, on conviction before two justices, forfeit a sum not exceeding five pounds, together with the costs of the prosecution; and, on a second conviction, the justices may order the particulars of the offence to be published, in any manner that may be deemed desirable. Power is given to local boards to appoint competent analysts (subject to the approval of one of Her Majesty's principal Secretaries of State), to examine articles alleged to be adulterated, and to report thereon; but opportunity must be given to the

seller of the article alleged to be adulterated, to accompany the purchaser to the appointed analyst, in order to secure such article from being tampered with. The purchaser of any article of food or drink in any borough or district may, on the payment of a small fee, not exceeding 10*s.* 6*d.*, obtain from the local analyst a certificate of his opinion as to the adulteration or not of the article submitted to him, and such certificate, when confirming the suspicion of adulteration, will be sufficient evidence to convict; an appeal, however, to the Quarter Sessions, is permitted. Thus, supposing the appointed analyst to be in error, and notice of appeal to be given against the justice's decision, the defendant is not likely to suffer much in reputation, and at the Quarter Sessions he can, armed with competent witnesses, vindicate the purity of his goods. After a careful consideration of this Act, we think it is calculated to render good service, by deterring unscrupulous dealers in alimentary substances from tampering with their goods, while it leaves the manufacturers, so long as they have proper regard for the health of the community, and make no false representation of what they are selling to the dealers, to prepare what mixtures they may deem desirable.

Another social reform effected in the last session, although affecting only the metropolis, possesses something more than local interest, as it is a public acknowledgment of a principle too often lost sight of by our legislators. We refer to the Act "for better regulating the supply of gas to the metropolis." There exists at present in London, without reckoning those in the outskirts, no less than thirteen companies for supplying the public with gas. So far from these having distinct teritories, they competed sharply with each other for customers, to supply whom the streets were necessarily interlaced with gas mains. The outlay thus occasioned, and the constant expense of keeping the mains in repair, owing to the constant disturbance of the earth by water and telegraph companies, the surveyors of sewers, and the rival gas companies, induced all the metropolitan gas companies to arrange among themselves for a division of districts; and this having been settled, the Act, cap. 125, bestowed the sanction of Parliament on their proceedings. Thus, instead of gas being supplied by several mains in the same district, each company confines its supply to a separate district; thereby economising capital, and avoiding the too frequent displacement of the pavement for the purpose of effecting repairs. The Act also determines the quality of the gas to be supplied, and limits its cost, and provides for a sufficient quantity being supplied; the companies being placed under the control of the Secretary of State for the Home Department. The illuminating power of the common gas is not to be less in intensity than twelve sperm candles,-at six to the pound, and the cannel gas is fixed at twenty candles' strength. With respect to its purity, it is

not to discolour turmeric paper, or paper imbued with acetate or carbonate of lead, during one minute's exposure to a current issuing at a pressure of five-tenths of an inch of water. Failing to comply with these conditions, the gas companies are liable to a fine of fifty pounds on conviction before a police magistrate. As in the Act above noticed, so in this, provision is made for the local authorities to appoint competent examiners, who, for a fee of 10*s*. 6*d*., shall report to any consumer on the illuminating power and intensity of the gas supplied, and such consumer may make complaint to any magistrate, and thus obtain summary redress. The cost of common gas is fixed at 4*s*. 6*d*. per thousand cubic feet, and cannel gas at 7*s*. 6*d*. Power is given to the Secretary of State, at the expiration of every three years, to alter the boundaries of the districts, either with or without the consent of the gas companies. But as this power is never likely to be exercised in hostility to an existing company, so long as there is no real ground for complaint, the several companies may be said to hold a monopoly of their privileges while they act up to the spirit of their engagements. Injurious competition in this department is therefore happily got rid of, and it is to be hoped that all industrial enterprises for which Parliamentary powers are required may, for the future, be dealt with in the same enlightened spirit. We have seen enough of disaster in the disregard of this policy in connection with our railways, but we trust that for the future it will not be deemed patriotic to look with hostility on every successful commercial enterprise, and to offer encouragement to every unprincipled speculation which aims at competing for a share in the reward which has deservedly fallen to the lot of successful enterprise.

RECENT PATENTS.

To JOHN FORSTER MEAKIN, *of Baker-street, Portman-square, for an improvement in envelopes.*—[Dated 20th January, 1860.]

THIS invention consists in the application to the interior of envelopes of black, red, or other colored matter, or transfer material, in such a manner that any mark or impression made thereon, such, for example, as the various stamps employed by the post offices, denoting the time of posting, may, by such act of stamping, be transferred to the enclosure of the said envelope; thus proving the date of its transmission through the post, and thereby rendering, in fact, the letter or enclosure an entire document, as of old (with the post marks thereon) before the introduction of envelopes, and identifying the contents with the envelope.

To Otto John Theodore Gössell, *of Moorgate-street, for improvements in the construction of locomotive engines,—being a communication.*—[Dated 5th January, 1860.]

This invention relates to improved means for supplying the fireplaces of locomotive engines with air to support combustion, and to enable them to burn coal without giving off smoke. To this end, the engine is fitted with an air tube or channel, which extends from the back of the engine to the centre of the grate, and stands up above the grate bars, and thereby forms a heating chamber for the incoming air. This air tube, at the parts exposed to the fire, is either covered with or composed of fire-clay, and it is covered at top with a shield, for the purpose of preventing the coals, when carelessly thrown into the fireplace, from entering the air channel. The air tube passes down through the ash-pit, and its outer and lower end is closed by a valve or damper, which is operated by a rod to regulate the supply of heated air to the fire, or to cut off the supply when required.

In Plate VIII., fig. 1, is a longitudinal section of an ordinary locomotive furnace or fire-box, fitted according to this invention. A, is the fireplace, and B, B, the fire bars, through the middle of which stands up the apparatus for supplying heated air to the furnace. This apparatus consists of a four-sided chamber *a*, inserted in the ash-pit, and formed of sheet iron, with an upturned end projecting into a four-square tube *b*. Over this square tube is placed a cast-iron flange-piece *c*, for supporting a round tube made of rings of fire-clay *d*, d^1. On the top of this tube is placed an iron ring *e*, which is cast with lugs on its inner face, to receive binding rods. The lower ends of these rods enter lugs cast for them in the square tube *b*, and the binding together of the several parts *b*, *c*, *d*, d^1, and *e*, is effected by passing these rods through cross bars *g*, *g*, and keying them up. In these cross bars *g*, *g*, sockets are made to receive a central rod *h*, which carries at its upper end an iron shield *i*, which covers the opening of the air tube, so as to prevent coal from falling therein, when the fireplace is carelessly fed by the stoker. This cover acts also as a deflector to the heated air, and causes its thorough diffusion through the furnace. The entrance of air to the chamber *a*, is governed by a flap valve or damper *j*, which is secured to the boiler casing by a hinge, and is operated by means of a notched bar *k*, jointed to the damper. Into the notches of the bar *k*, a click *l*, takes, for holding the bar in suspension, and keeping the damper opened at any required angle, whereby the amount of air supplied to the chamber may be adjusted. To permit of air being admitted to the furnace between the fire bars, the upper part of the chamber *a*, may be hinged, and secured in position by a bolt or catch. In order, then, to direct the air to the fire bars, it will only be necessary to let down this hinged piece, as indicated by dots in the figure, and the central air passage will be closed, and the air entering by the open damper will ascend to the furnace through the openings in the fire bars. From the above description it will be understood that the air, as it passes up the air channel in the direction of the arrows, will have its temperature considerably raised, and when issuing out at the top of the air supply tube and mingling with the combustible gases evolved from the burning fuel, it will effectually ensure their conversion into flame, and prevent the discharge of smoke from the furnace.

The mode of adapting the invention to locomotives, when in the course

of construction, is shown in longitudinal section at fig. 2, and fig. 3 is a transverse vertical section of the same. As will be observed, the principle of construction, so far as the supply of air to the fireplace is concerned, is the same in this as in the above-described arrangement; but increased heating surface is, in this arrangement, provided. The atmospheric air passes by the open valve or damper *j*, into the tube or chamber *a*, where it is warmed, and on arriving at the discharge opening *a*, it is completely heated, by reason of the opening being furnished with edges of fire-clay a^2, a^2, as shown best at fig. 3, and fitted with a cylindrical core of fire-clay a^3, fixed in the middle of the tube *a*, and over which the air must pass on its exit from the tube. There are double wallings in the middle of the fire-box, which divide the fire-box into two compartments, and form a middle water space. These wallings are constructed after the ordinary manner of the casing of locomotive fire-boxes, and are intended to give firmness and stiffness to the case, to secure it against high steam pressure, while at the same time they present a great increase of efficient heating surface. This division of the fireplace assists in obtaining uniform firing, and therefore essentially furthers the economical consumption of the fuel employed. By reason of the slanting construction of the roof of the middle walling, from A to C, the water at the highest temperature is in constant contact with the copper wallings, so that the liability of steam bubbles collecting, and, consequently, of the copper being burned at the part where these collect, will be prevented.

The patentee claims, "supplying the furnaces of locomotive engines with heated air, and otherwise economising the heat derived from the burning fuel by the means above described."

To THOMAS WILSON, *of Birmingham, for improvements in breech-loading firearms.*—[Dated 14th January, 1860.]

THIS invention consists, firstly, in the method of constructing the parts for opening and closing the breech ends of firearms. In Plate VII., fig. 1, represents, in vertical longitudinal section, a portion of a rifle constructed according to this part of the invention. This weapon is adapted for the use of sealed cartridges having an expanding wad. *a*, is an elongated breech, forming part of the barrel *b*, which breech may be plugged at *c*, or left open if preferred. On the upper side of the elongated breech an opening is made, through which the cartridge is introduced into the barrel, and into which the block or stopper which closes the breech end of the barrel, whilst firing, enters, as hereinafter explained. An arm or lever *d*, is hinged to the top of the barrel at *e*, and on the under side of the arm or lever is a solid block or stopper *f*. When the lever *d*, is thrown back, as indicated in dotted lines, the elongated breech *a*, is open, and the charge may be introduced into the elongated breech end and pushed forward into the barrel *b*. On shutting down the lever *d*, the block or stopper *f*, is brought into the elongated breech *a*, and made to close the end of the barrel, as represented. The lever *d*, and stopper *f*, are fixed during discharge by means of a cotter or bolt *g*, which bolt passes transversely across the elongated breech *a*. The cotter or bolt *g*, passes through openings in the sides of the elongated part *a*, and takes into a groove in the end of the stopper or block *f*. The stopper *f*, is thus fixed down during

discharge, and firmly supported by the elongated breech. After firing, the bolt *g*, is withdrawn, and the arm or lever *d*, and stopper *f*, raised for recharging. The end f^2, of the stopper *f*, is made conical, and embeds itself against a conical seat formed in the end of the barrel *b*. The lever *d*, and stopper *f*, may work in a horizontal instead of a vertical plane.

The invention consists, secondly, in the method of constructing the breech ends of breech-loading firearms, and the parts connected therewith, for opening and closing breech ends, such as that shown in horizontal section at fig. 2. Breech-loading firearms constructed according to this principle, are suitable for use with open-ended cartridges, without wads, or with loose powder. At the breech end of the barrel *h*, is an enlarged part *i*, of sufficient size to receive the moveable breech or charge chamber *k*. The chamber *k*, is, in internal diameter, somewhat larger than the bore of the barrel *h*. On the side of the enlarged part *i*, is an opening of such a size as to permit the charge chamber *k*, to readily pass into and out of the enlarged part *i*, through such opening. The moveable breech *k*, is hinged to the barrel *h*, at *l*, and by turning it upon its hinge, it may either be introduced into the enlarged part of the barrel, as represented, or be withdrawn therefrom, with its open end turned from the muzzle of the gun, as indicated in dotted lines. When the moveable breech is forced into the enlarged part *i*, of the barrel, it constitutes the closed end of the barrel. The percussioning may be situated on either side of the breech *k*. During the discharge, the breech is fixed in its place by means of the screw-bolt *n*, working in the solid end *o*, of the enlarged part of the barrel. By turning the screw-bolt *n*, by its thumb-plate *p*, the end of the screw-bolt is made to bear against the closed end of the breech, and thereby to transfer all strain from the hinge *l*, during discharge to the solid end *o*, of the barrel. Instead of fixing the breech by means of a screw-bolt *n*, a wedge or a bolt, similar to that represented at *g*, in fig. 1, may be employed.

The patentee claims, "Firstly,—the arrangement or combination of parts described and illustrated in fig. 1, for opening and closing, and securely fixing when closed, the breech ends of breech-loading firearms. Secondly,—the arrangement or combination of parts described and illustrated in fig. 2, for opening and closing, and securely fixing when closed, the breech ends of breech-loading firearms."

To JOB GOULSON, *of Vauxhall Bridge-road, for improvements in gas-meters.*—[Dated 17th January, 1860.]

IN Plate VII., fig. 1, is a front view of a meter constructed according to this invention, with the front plates removed to show the interior. *a*, is the cylindrical portion of the outer case containing the measuring drum *b*, and constructed in the ordinary manner with a square frame a^1, on the front of the cylinder, but without the partition plate, which in ordinary meters separates the measuring drum compartment from the frame or box a^1, and the two compartments are thrown into one containing measured gas. *c*, is the water chamber or reservoir; *d*, the gas inlet, opening into the valve-box *e*, the end of which is removed to show the valve e^1, by which the gas passes to the reservoir *c*; it afterwards passes through the bent pipe *f*, into the measuring drum, and escapes into the outlet chamber measured, and finally from the meter at the outlet *g*. The valve e^1, is

jointed to the lever h, as shown by dotted lines, to allow it to find its seat and shut off exactly, should the lever contract or expand by change of temperature. The lever h, turns on a fulcrum or axis i, and is counterbalanced by the weight j: at k, it is jointed loosely to the wire l, which passes up through the tube m, and screws into the nut n, by which means the float o, and valve e^1, are easily adjusted to suit the water line.

By arranging the supply valve, as above described, to be acted on by a lever, which is itself moved by a float placed between the valve and the fulcrum of the lever, a smaller motion of the float is required to open and close the valve, than when the valve and float are so connected together as to move through the same space, and the float being placed under the pressure of the measured gas, is not influenced to the same extent by changes of pressure in the gas mains as when it is placed under the pressure of the unmeasured gas. Beneath the lever h, and jointed loosely to it, is the small metal ball p, having the specific gravity of water, and which, so long as it is immersed in the water, does not act on the valve, but so soon as it begins to uncover, it will hang upon the float, and before the water is so low as to throw the pump, hereinafter described, out of action, it will drag down the float and close the valve. Should any attempt be made to obtain gas from the reservoir by sucking or blowing out the water, or should the screw be left out through negligence, the valve will be shut by the ball p, thus preventing any accident or fraud. q, is the barrel of the pump for raising water to the measuring compartment of the meter. It has a hole in the centre of the bottom (see fig. 2), serving as a seat for the valve r. s, is the plunger of the pump, which at its lower end has a small tube or recess to receive the stem of the valve r. On the top of this stem is an enlargement or knob r^1, by means of which the plunger, when it comes to the top of its stroke, raises the valve a short distance from its seat, to allow the water to flow into the barrel of the pump, and to prevent the valve from sticking to the plunger and being carried up and down with it, the small knob r^2, at the bottom of the valve stem is used. At the upper end, the plunger s, is hung freely by links to the end of the lever t, which at its other end beyond the fulcrum or axis t^1, has a counterweight t^2; and between the plunger and the fulcrum or axis is the projecting arm t^3. u, is a spiral, placed on the spindle of the index, and turning with it as it revolves; it raises the lever t, by the projecting arm t^3, and with it the pump plunger, until it arrives at the summit of the spiral, when the plunger falling suddenly, the valve closes, and the water, being pressed upon by the plunger, is forced up the barrel and over the top into the measuring compartment of the meter. The counterweight must have the plunger sufficiently heavy to press up the water, but not so heavy as to cause unnecessary friction on the spiral: the plunger should also have plenty of play in the barrel to prevent friction and allow the water to flow up freely. v, is the pipe, by which the meter is filled with water; w, is a pipe, by which it overflows from the measured gas compartment to the water reservoir.

In fig. 3, another mode of raising the lever is shown, viz., by means of a bevil-wheel 1, placed upon the index spindle, and driving the bevil-wheel 2: the spindle passes through a bearing 3, and has upon its end a cam, which, by rotating, alternately raises and releases the plunger.

The patentee claims, "First,—the combination of the parts of a meter, as described. Secondly,—the use of a supply valve, mounted on a coun-

terbalance lever, and actuated by a float, so placed, as to be exposed to the pressure of the measured gas, as described. Thirdly,—the use of a pump with a plunger or piston, having a to-and-fro motion, as described, for raising water to the measuring compartment of the meter. Fourthly, —the use, as described, of a metal ball, having about the same specific gravity as water, for closing the valve when a deficiency of water occurs in the reservoir."

To JOHN BARKER BERGER, *of Upper John-street, Fitzroy-square, for an improved mode of, and apparatus for, ascertaining the proper course to steer ships or vessels.*—[Dated 18th January, 1860.]

THIS invention relates to a means of ascertaining the proper course to steer ships or vessels, consisting of a moveable compass, in combination with a sphere or hemisphere, upon which the ship's track, from the point or port of departure to the point or port of arrival, may be drawn in a straight line on the spherical or curved surface, by means of a qudrant or arc made to fit the spherical surface. Such a line would form an arc of a great circle of the sphere, and the course to be steered to cause the ship to follow this track may be found on the moveable compass card or disc, by ascertaining what points of the compass are coincident with a line which is parallel to the line or course marked on the spherical surface.

In Plate VII., fig. 1, is a plan view of the improved apparatus, which the inventor denominates a sphereometer: and fig. 2, is a vertical section of the same. The spherical surface should be constructed of wood, paper, papier-maché, or some other suitable substance which is capable of holding the well-known compositions or preparations on which marks may be made with either a slate or lead pencil; and on this surface should be marked the lines of latitude and longitude. For use on board ship it will be found most convenient that the sphereometer should consist simply of a hemisphere, as at *a*, *a*, which may be secured on a foundation board *b*, *b*. At the zenith or pole a metal plate *c*, should be inserted, and have a hole made at the centre thereof, to receive a pin or stud *d*, whereby a moveable quadrant or arc *e*, may be held in its place, but in such a manner that the arc or quadrant may be moved round in either direction on this pin or stud. The compass *f*, is simply a dish-shaped metal or other disc, with the points of the compass marked thereon. This compass is not a fixture, but may be placed over any part of the sphereometer where it may be required. In using the instrument, the meridian of the ship's place is first ascertained by means of the quadrant of altitude *e*, or other equivalent instrument or contrivance, which is to be adapted to the pole of the sphere, and secured there by means of the pin *d*, and a line is drawn on the sphere to indicate that meridian. The arc or quadrant *e*, may then be removed from the pole, and the ship's intended track is then to be drawn on the spherical surface by means of a pencil, and the curved quadrant or rule, which is of course constructed to fit any part of the curved surface of the sphereometer. Upon placing the compass disc *f*, on the ship's place in such a manner that its north and south poles are coincident with the meridian, and the centre of the compass is exactly over the ship's place, the true bearings of the track can be read off from the edge of the compass at that point which is immediately over the track marked on the sphere.

The meridian line *g*, in fig. 1, may be supposed to be the meridian of the ship's place at starting; and supposing the ship to have reached the point *i*, over which the compass is placed, and not to have deviated from her course, the bearings of that place may be ascertained in the same manner as at first; that is, the meridian of that place must be drawn on the sphere as before, as at *h*, and then, upon placing the compass thereon with the north and south line of the compass over the meridian and the centre of the compass on the ship's place, the new course to be steered will be seen at a glance. It will, of course, be understood, that as the latitude of the ship's place is constantly varying, the bearings will vary with it, and therefore, in order to keep the ship from deviating, recourse should be had to the sphereometer, at, say, every fifty or sixty miles, and the latitude and longitude of the ship should be checked by observation in the usual way, to see if the ship has deviated from the proper course; and should any deviation have taken place, a new course must be marked on the sphereometer, and the true bearings taken therefrom.

The patentee claims, "the ascertaining the proper course for steering a ship by means of a moveable compass applied to a spherical surface in the manner above set forth." And second, "the apparatus, above shown and described, whereby such object can be effected."

To PAUL MOORE *and* PAUL MOORE, jun., *both of Birmingham, for improvements in the manufacture of the dies or draw-plates used in drawing wire and tubes, and for other similar purposes,—being partly a communication.*—[Dated 20th January, 1860.]

THIS invention consists in the production of a hard and economical draw-plate for the manufacture of wire and tubes, and for other similar purposes, by casting such draw-plates (which may be made either of iron or steel, or a mixture of both) in iron or steel moulds, or by what is usually known as the process termed chill casting; and as it would be difficult after chill casting such plates in the lump or block, to punch out or drill the necessary dies or apertures through which the wire or tube is to be drawn, by reason of the extreme hardness of metal gained by chill casting, the dies or apertures are formed simultaneously with the casting of the plate: plugs of iron or steel are used, of the section and size or gauge necessary for the shape and size or gauge of the wire or tube, or other article to be produced, which plugs are accurately turned in a lathe, if wire or tube or other article of a round section is desired to be produced; but if a section other than round be required, then the plugs are made by hand, or in any other suitable manner, to produce the shape desired, so as to be perfectly true and uniform; and these plugs being inserted through holes in the mould or ingot in which the draw-plate is to be cast, pass through, until their points reach home a short distance into the lid of the mould as far as may be required, so as to perfect the face of the casting or draw-plate.

The figure in Plate VII., shows a longitudinal section of the mould or ingot with the plugs inserted, and in which *a*, represents the ingot or mould; *b*, the lid; *c*, the plugs; *d*, the metal casting or draw-plate; *e*, projecting ribs in the mould, for the purpose of forming a groove or sinking in the casting, to facilitate the operation of breaking away any super-

fluous metal when the casting has cooled. The plugs being inserted, and the parts of the mould bound together by clips, the molten metal of which the draw-plate is to be formed, whether of iron or steel, or a mixture of both, is poured into the mould, flowing round the plugs and imbedding them. It is then allowed to cool, when the plugs are withdrawn, the upper ends of the plugs being flattened, to allow of a better hold being obtained: the parts of the mould are separated, and the casting taken out ready for use. By this process, not only the draw-plate itself, but the inner surfaces of all the holes or dies in the draw-plate also, are chill cast, by their contact with the iron or steel plugs, and the result is, that a cheap and hard draw-plate is produced. It may sometimes happen that the dies or apertures in the casting may have some slight imperfection of form; should this occur, a "rimer" of steel, hardened for the purpose by being heated to a red heat and then struck into lead, is employed, with which tool the dies are cleared out or rounded off to a clean section. This same process, by means of the rimer, may also be adopted to re-adjust the holes for another size or gauge of wire or tube after the plate has been in use.

The patentees claim, "the improvements described in the manufacture of the dies or draw-plates used in making wire tubes, and for other similar purposes, by casting such dies or draw-plates of the materials, and substantially in the manner set forth."

To George Ryder, *of Lenton, Nottinghamshire, and* John Clay, jun., *of Nottingham, for a high-pressure stop valve or cock.*—[Dated 25th January, 1860.]

This invention relates to the construction of a high-pressure steam, water, or fluid tap or valve, for the regulation of steam, water, or other fluids, and consists of a valve or plug worked by a crank or excentric which is seated within, and can be used either with or without the operation of a spring, and also without the use of packing.

The figure in Plate VII., is a sectional view of the improved valve as cut through the crank-pin or excentric. *a*, is the casing, the inside of which is turned to form a seating for the valve or plug *b*, which has four projections on one side, which serve as guides and ensure that the valve shall move steadily while rising and falling. The valve is forced into its seat and held closed by a crank-pin *c*, bearing upon the upper side of a slot in the lower side of the valve-plug *b*, as shown. *d*, is a plug or screw-threaded ring on its inner surface for a portion of its length, and also screw-threaded on its outer surface for a portion of its length: this plug or ring is screwed into the casing *a*, after the valve-plug *b*, is inserted: the portion of the inner surface of the plug *d*, which is threaded, and the upper end of the casing *a*, which is also threaded, are for screwing the valve to the ends of two pipes to be connected or coupled. The crank-pin *c*, passes through a boss, having a V-shaped shoulder turned out on its inner side; the boss is screwed into a projection on one side of the casing *a*; one end of the crank-pin projects beyond the boss, and has a key wrench *e*, fitted upon it by which the valve is opened or closed. The crank is kept close to the shoulder of the boss by a spring lying

between the other end of the pin and a plug *f*, held in a smaller boss on the other side of the casing *a*.

The patentees claim, "the arrangement and combination with the valve or plug, of a crank or excentric seated within the casing of the valve, to be used either with or without a spring, and also without the use of packing, as described."

To THOMAS DONKIN, *of Bermondsey, for an improvement in paper-making machines.*—[Dated 25th January, 1860.]

THIS invention refers to that part of the paper-making machinery known as the pulp knotter or strainer; it consists in giving a corrugated form to the plates thereof in which are the slits or apertures through which the pulp passes, whereby, among other advantages, cheapness, lightness, and strength are secured. The knots or impurities fall into the bottom of the grooves between the ridges, from whence they may be readily collected and removed.

The figure in Plate VII., is a section of so much of a paper-making machine as will serve to explain in what manner the invention may be conveniently carried into effect. *a*, is the pulp knotter or strainer; *b*, *b*, are the plates formed with slits, as shown. These plates are, by preference, corrugated into the form shown. The knots or impurities fall into the spaces marked *c*, *c*, included between the corrugations, and are easily removed therefrom.

The patentee claims "the method of forming the pulp knotter or strainer of paper-making machinery of a corrugated form, as described."

To FREDERICK WALTON, *of Haughton Dale, Denton, near Manchester, for improvements in the manufacture of varnish, and in treating oils, also in the application of products obtained therefrom.*—[Dated 27th January, 1860.]

IT is well known that when drying oils are exposed to the action of air, or are oxidized, they become converted into bodies of a semi-resinous nature. Now, according to this invention, the patentee converts drying oils into semi-resinous bodies, and dissolves them in volatile solvents. The preparation, thus obtained, dries rapidly, like spirit varnishes, and leaves a flexible and tough film, similar to that produced by the application of oil varnishes, which take a long time to dry or harden. Drying oils may be converted into semi-resinous matters, by laying a thin film of the oil on a surface of considerable extent, and exposing the film to currents of warm air till the change is produced. The semi-resinous matter may be removed from the surface, when it is desired to produce a varnish, by washing the surface in the solvent; or it may be separated by scraping the surface; or if the process be stopped before the change is complete, it may be separated by placing many layers of the material (usually paper or fabric) on which the oil was laid, one over the other, and submitting the pile to a heavy pressure. In order to render the change of the oil, when exposed in thin films as above mentioned, more rapid, the oil is prepared by driving it, by means of a considerable pressure, through

jets or orifices in very fine streams, which are caused to pass through a case constantly supplied with warm air.

In order to obtain a semi-resinous body, or to increase the drying properties of an oil, perfectly clear and bright linseed oil is mixed with some suitable drier, from 5 to 10 per cent. of acetate of lead being preferred; this mixture is passed through the machine shown in vertical section in Plate VII., *a*, is a pipe leading from a force pump, by which the oil is forced into the vessel *b*; at the bottom of this reservoir is a grating *c*, supported on a suitable gridiron frame. The oil forced through the perforations falls in a fine shower through the column *d*, and as it falls, it comes in contact with a current of air forced in at the opening *e*, by a fan. The two sides of the column are enclosed with glass, in order that light may enter the column, as it tends to bleach the oil. *f*, and *f*[1], are sheets of perforated zinc: through the sheet *f*, the air enters the column, and through the sheet *f*[1] it escapes from it. These perforated sheets diffuse the air entering at *e*, and prevent the fine streams of oil from being blown out of the column. The current of air that passes through the apparatus need not be very strong, as all that is required is constantly to change the air in the column. The front of the apparatus may either be left open, as is shown, or a casing may be employed to conduct the air which has been brought in contact with the oil into a flue. The oil descends into a cistern *g*, under the bottom of which is a steam space *h*, by which the oil under treatment is kept at a temperature between 212° and 550° Fahr. When the higher temperatures, however, are employed, it is convenient to substitute for steam, as a heating medium, a bath of a fusible metal, such as tin or an alloy of tin and lead, the higher the temperature the more rapid will the process become. *i*, is a pipe communicating with the oil pump for taking the oil from the cistern *g*, and returning it to the top reservoir *b*; thus the same oil is kept circulating through the machine until it is judged to be sufficiently viscid for the purpose for which it is required. At the top of the reservoir *b*, is a small cylinder *j*, in which a piston *k*, works; *l*, is a lever in connection therewith, weighted to the pressure which it is desired to maintain in the vessel *b*. From the lever *l*, a rod *m*, descends, and is connected with a cock in the pipe *i*, in such a manner that when the piston *k*, rises from excess of pressure, the communication between the oil pump and the cistern *g*, is cut off.

Oil treated as above described, when it has thickened sufficiently, is suitable to be used by painters and others in place of boiled oil, and it will be of a better colour.

In some cases—particularly when it is desirable to work with as little lead as possible—the oil is boiled in the usual manner of boiling linseed oil, before submitting it to the action of air, as before described. No acetate of lead is added after the boiling operation, and during the subsequent process the temperature of the oil is not raised to so high a degree as when working with unboiled oil: 212° Fahr. is sufficient. The product obtained from boiled oil will be more highly colored than that obtained by the use of unboiled oil. If the process is to be carried on to a sufficient extent to obtain a semi-resinous body, the process should not be carried so far in the machine above described as materially to reduce the fluidity of the oil; the change being afterwards completed by spreading the oil in a thin film on an extended surface. For this purpose, the oil is run into tanks; each tank is furnished with an open frame of

metal, which will just fit within it, and can be lifted in and out as required.

In order to distend in this frame a considerable length of fabric, one end of the fabric is attached to a bar, which is then dropped into guides in two uprights at one end of the frame. The fabric is then taken to the other end of the frame, and another bar is dropped over it into the guides in the uprights at the other end of the frame; it is then taken back to the point where it was first made fast, and a third bar is dropped in, and so on till the frame is full.

The frames, when thus covered, are dipped into the oil tanks, then drawn out again, and suspended above them, and while thus suspended, they are submitted to a current of air. It is a convenient arrangement to place a series of oil tanks in a row, side by side, in a suitable chamber, and to mount an axis about five or six feet over the row of tanks. These axes have drums mounted on them, and the fabric frames are connected with these drums by chains, so that by turning the axis, the whole of the frames suspended from it can be raised from, or lowered into, their tanks, as may be required. Air is forced into the chamber at one end, by a fan, and is allowed to escape at the other end. It is preferred, in order to keep the oil fluid, to heat the oil tanks by means of steam. In conducting the process, when a number of frames have been filled with fabric, and suspended over their oil tanks, as above described, they are, by turning the axis from which they are suspended, all simultaneously lowered into the oil tanks, and are then immediately lifted to their original positions. By this dipping, the whole surface of fabric is covered with oil, and any superfluous oil which may be taken up runs back into the oil tanks. The frames are kept suspended in the current of air, by preference, until the film of oil is dry, and no longer feels tacky when touched. This will take about twenty-four hours, but the time will vary greatly, according to the state of the weather. The frames, when dry, are re-dipped, and the process is thus continued until a thickness of dry oil, about $\frac{1}{8}$th of an inch in thickness, is accumulated on the surfaces of the fabrics. It will take some weeks to obtain a sufficient thickness. The frames, when a sufficient thickness of dry oil has been accumulated, are removed, and the fabric stripped from them. If woven fabric has been employed, in order to separate the dry oil or semi-resinous matter from the fabric the same is passed at a slow speed— say, about two yards per minute—between two plates heated with high-pressure steam, and having only sufficient space between them to allow of the fabric being passed through conveniently. Just beyond the plates are two rollers, the distance between which is adjustable by screws, or otherwise. The end of a length of coated fabric passing between the plates, is entered between the rollers, and the semi-resinous matter having been scraped off by hand from a few inches of the fabric, the rollers are caused tightly to nip the end so cleaned. The rollers are then set in motion, and by their pressure they separate the coating from the fabric, the former being constantly pressed back, whilst the fabric passes on between them, and is ready again to be placed on the frames. The semi-resinous matter separated from the fabric is differently treated, according to the purpose to which it is to be applied. If it is to be used for coating fabrics to waterproof the same, the semi-resinous matter is passed several times between crushing rollers, heated by steam, to break it down, and reduce it to a uniform plastic mass. It is preferred that one of these rollers should be driven considerably faster than the

other, in order that they may have a guiding, as well as a crushing action on the material, as it passes between them. During this operation, powdered gum lac, either shellac, seed lac, or button lac, should be worked in with it. The quantity of this gum to be employed varies according as it is desired that the coated fabric should be more or less flexible, and the composition more or less hard. If great flexibility be required, but ten per cent. of gum shellac is added; whereas, if a hard face is desired, as much as fifty per cent. should be added. When the mixing is complete, the composition is spread on the fabric by rollers, as is sometimes practised with india-rubber and gutta-percha. In place of completing the kneading of the material by means of rollers, it may, after being passed two or three times between the rollers to crush it completely, be further worked in a masticator, such as is used in the working of india-rubber and gutta-percha. In a similar manner, a composition suitable for rolling out into sheets without fabric, is prepared. In this case, however, flocks are preferred to be mixed in the masticator, or by means of rollers, to increase the toughness of the sheet. The composition may be rolled into sheets, as is practised when working gutta-percha, and it may in a similar manner be moulded by dies and pressure. It is preferred that the dies should be heated. Articles so produced may be rendered very hard by drying them thoroughly in a cool oven.

If it be desired to produce a varnish, the semi-resinous body, when it is removed from the fabric, is passed between chilled rolls, and crushed into a sheet about the thickness of tissue-paper. To this, alcohol or wood spirit is added, in the proportion of 6 gallons to 9 pounds of semi-resinous material, and the mixture is placed in a still, in which a shaft is mounted. It descends through a stuffing-box at the top, and has radial arms mounted on it, to stir the mixture, and arms are mounted on the still itself, between which the arms on the shaft pass. Heat is applied to the mixture until the semi-resinous material is completely dissolved. A portion of the solvent distils over, and may be at once returned to the still, or may be employed in a subsequent operation. By distilling off more or lest solvent, the thickness of the varnish may be regulated as is required; or the varnish may be made by using chilled rollers, and working the semi-resinous material along with the solvent until a paste is produced, which may then be completed by heat in the still. For many uses, this varnish will be improved by adding to it a solution of shellac, or other resins soluble in the same solvent as the semi-resinous body, which tends to harden the varnish.

When the semi-resinous material is to be employed in the manufacture of varnish, it is convenient in some cases to expose the films of oil to the action of the air on sheets of paper, in place of on a woven fabric of cotton; and in this case, the coating is not removed from the paper by rollers, as above described, but the paper, with its coating of semi-resinous matter, is placed in the solvent, and the paper is broken up, and afterwards separated by filtration.

To Alfred Vincent Newton, *of Chancery-lane, for an improvement in the construction of ships' stoves,—being a communication.*—[Dated 4th February, 1860.]

The object of this invention is to enable ships' stoves to retain an upright position without any interruption to the draft whatever during the rolling or pitching of the vessels in which they may be set. To this end, the stove is suspended on hollow pivot joints in a swinging gimbal-like frame, part of which constitutes a flue for conducting the smoke and products of combustion from the stove to the chimney, the vent from this frame to the chimney being in one of the pivot joints by which the frame is supported.

In Plate VIII., fig. 1, is a vertical section of a ship's cooking stove; and fig. 2 is a plan of the same, partly in section. A, is the stove; B, is the swinging gimbal-like flue frame, in which the stove is hung by the hollow pivot joints E, E, arranged opposite each other, one on each side. One half of this frame is made hollow to constitute a flue *a*, to receive the smoke and gaseous products of combustion through the hollow pivots E, E, and convey them to the chimney C. The frame B, has its two pivots *h*, and D, by which it is hung in the standards F, F^1, arranged at right angles to the hollow pivots E, E. The pivot *h*, may be solid, but the pivot D, which forms the joint or communication between the flue in the frame and the chimney C, erected upon the standard F^1, is hollow. The course of the draft from the stove through the pivot joints E, E, flue *a*, and pivot joint D, to the chimney C, is indicated by arrows. The hollow pivot joints E, E, and D, are formed each of two pieces, made separate from the stove and the frame D, viz., a thimble *b*, and a socket *c*. The thimbles *b*, *b*, consist each of a short tube provided with a flanch *d*, having its side edges made of dovetail-form to fit (as shown in fig. 2) into dovetail groves in the hollow portion *a*, of the frame B, which constitutes the flue; such portion *a*, having suitable openings to form communication between the thimbles and its interior. The sockets *c*, of the joints E, E, consist of short tubes, large enough to fit easily to the exterior of their respective thimbles *b*, *b*, and are provided with lugs *f*, *f*, to receive bolts *e*, *e*, by which they are bolted to the stove. Openings are provided in the stove opposite to these thimbles, to connect them with its main flue *g*. The socket *c*, of the joint D, which is bolted to the chimney standard F^1, is made to fit the interior of the thimble *b*, instead of the exterior, as is the case in the joints E, E. The object of this difference is to bring the bearing at the top of the joint in both cases, and thus to keep the weight of the stove as far as possible below the bearings. In the construction of the stove and its frame B, care should be taken that the pivots E, E, D, *h*, be respectively so arranged that the stove will be as nearly balanced as practicable, that it may hang as nearly as possible in an upright position, and the same position will be maintained in all the movements and changes of position of the vessel, without disturbing the communication that is provided between it and the chimney by the pivot joints E, E, flue *a*, and pivot joint D. Cabin stoves or any other stoves used on shipboard may be hung in the same manner as the cooking stove represented. In some kinds of stoves it may be sufficient to have but one of the pivots E, E, hollow.

The patentee claims, "combining a stove for use on shipboard with its chimney by means of hollow pivot joints and a swinging gimbal-like tubular frame, in the manner and for the purpose specified."

To WILLIAM EDWARD NEWTON, *of Chancery-lane, for improvements in rails, rail supports and fastenings, and the nut fastenings of rail bolts for the permanent way of railroads,—being a communication.*—[Dated 8th February, 1860.]

THE first part of this invention consists in a peculiarly formed reversible rail, which, on account of its configuration, it is proposed to denominate the reversible Z-rail; with this rail is combined the double-headed with the flat-footed rail, being flat-footed one side and double-headed (so far as the wheel tread is concerned) on the other side, the requisite strength being preserved with a much less weight of iron than usual.

The second part of the invention consists in supporting, bracing, and giving an artificial bearing to railway rails, particularly the Z-rail at the intermediate cross-ties between the joints, or, if necessary, at the joints themselves, so as to obtain at such points on the cross ties any desired width of rail base, without adding to the weight of the rail, and without using bolts to effect this object.

The third part of the invention consists in securing the joints of railway rails by means of brackets and fishing bars, and at the same time securing the rail brackets and fishing bars down firmly to the cross ties or sleepers,—dispensing with the ordinary screw-bolts and the objections attending their use; while the parts forming the rail will be rendered more substantial and less liable to injury, or to come loose by the passing and repassing of the trains over the rail.

The fourth part of the invention consists in a novel method of securing the rail joints by bolts, and in preventing them from working loose in consequence of the jars and concussions of passing trains, and thereby obviating the main objections to the use of bolts and nuts for this purpose.

The fifth part of the invention is an improvement in railroad spikes, and it consists in forming a rail spike head of a peculiar shape, with a supplemental lip in the back of the head, for allowing the insertion under it of an edged crowbar for drawing out the spike.

In Plate VIII., fig. 1, represents a transverse section at the rail's joint, showing the reversible Z-rail, the angular bracket, the inside fishing bar, the rail bolt and nut, with this nut locked in place by the nut fastening on the outside of the rail, the whole being held down to a cross tie by spikes. The rail is jointed between a pair of cross ties or wooden sleepers, and the joints of both lines of rails are opposite each other. Each pair of bolts clamping the bracket and fishing bar to the end of each rail are placed over a cross tie or sleeper, and the nuts of each pair of bolts have a nut fastening of their own. The square shoulder of the rail bolt extends through the fishing bar and rail stem, in order to prevent the bolt from turning, A hook-headed spike *d*, holds the nut fastening in its place on the outside of the rail. Fig. 2, is a top view of the nut fastening, showing the bevilled recess for the reception of the spike head. The position of the head, when properly seated in the nut fastening, is shown in dotted lines, also the square shank of the spike. Fig. 3, is an end view of the Z-rail, with an oak or other wood piece outside, intermediate between joints, for supporting and stiffening the rail laterally. Fig. 4, is a transverse section of the rail at an intermediate point between the rail joints. A two-bolt outside bracket, without the fishing bar inside, would be used as shown, in this instance, to give additional strength to the rail at one or

more points intermediate between the rail joints. Fig. 5, is a transverse section of a flat-footed rail recessed into the top of the wooden sleeper, with the joint secured by the ordinary fishing bars. It represents the application modified to suit the required conditions of the nut fastening to the nuts of fishing bar rail bolts. Fig. 6, is another transverse sectional view, in which the rail is not recessed into the cross tie or wooden sleeper, as in fig. 5. Fig. 7, is a transverse section, showing the application of the nut fastening to the bolt nuts of side brackets when used with flat-footed, rails. Fig. 8, is a similar view, except that the rail is double headed. Fig. 9, is a transverse section of the rail and its support at a point intermediate between the joints, with a cast-iron knee brace-bearing piece. Fig. 10, is a transverse section similar to fig. 9, except that the rail end and the brace-bearing piece are not recessed into the sleeper, but a footing is shown, as given to the brace-bearing piece, for relieving the lateral strain from the spike. Fig. 11, is a transverse section representing a wedge bolt rail joint. Fig. 12, is a top view or plan of the wedge bolt used in fig. 11. Fig. 13, is a transverse section through the centre of the wedge bolt of a wedge bolt rail joint for use, with rolled iron fishing bar and bracket. Fig. 14, is a brace-bearing piece of a peculiar pattern, with a web on the inside, and in the middle of its length. A, represents the reversible rail, formed with its stem to one side of the centre line of the rail, so that when the rail is laid down upon the cross ties or sleepers, the thin edge B, to the head at the rail base is inside and outside at the rail head, forming a reversible flat-footed and double-headed Z-rail, possessing all the advantages of the reversible rails, with a much less weight of iron, and adding strength against breaking down to the rounded inside lips C, where the strain is greatest. In the general arrangement of this rail, in order to give it permanency, at the rail joints two cross ties I, I, are used, and placed at a suitable distance apart. The joint bracket E, and fishing bar E^1 will each be twenty-two inches long, and the bolts which clamp them to the rail will be six inches from centre to centre. The slots for the hold-down spikes G, will be punched midway between the outer pairs of bolts, and the two single two-bolt nut fastenings will be used at the rail joint; this will bring the rail joint between the two joint ties, which are four inches apart. The rails in this instance will be rolled in thirty feet lengths, and at each ten feet of the rail's length a ten-inch (or two-bolt) bracket is used outside, with no fishing bar inside, as shown in fig. 4. The bolt head abuts directly against the rail stem on the inside of the rail. Should it be found necessary, bolsters or angle pieces of wood spiked down to the cross ties outside may be used intermediate between the half brackets. The rail nut bolts all have a square shoulder, and square bolt holes in the inner fishing bar (or bracket, if used outside) and in the rail stem, so that only one nut fastening is needed on the nut side of the rail. The square shoulder will thus prevent the nut from turning, and the bracket on the nut side of the rail may be dispensed with, and the nut fastenings will lock the nuts securely and prevent them from working loose in consequence of the jar and concussion of passing trains.

The brace-bearing pieces are shown as applied to the Z-rail in figs. 9 and 11, which are recessed into the cross ties or sleepers, with a view of affording to the rail a better hold laterally upon the sleeper, as well as to reduce the level of the rolling surface, as compared to the bearing surface. The outward thrust or strain upon the hold-down spikes is much reduced

by so doing. This latter end may be accomplished without sinking the rail into the cross ties or sleepers, by casting a projection or footing H, upon the outer edge of the base piece J, which is recessed into the cross tie, as shown in fig. 10. These remarks are applicable to all the figures where this recessing or countersinking into the cross tie or sleeper is represented.

The brace-bearing piece for giving support and adding to the strength of the rail on the intermediate cross ties between the rail joints, consists in combining with the base portion K, which shall have any desirable width of base, a brace piece L, or, what would be essentially the same, casting with the knee bracket M, a brace piece or pieces L^1, extending from the outer edge of the tread of the rail, to the thin edge of the right angular base piece of the bracket. Or, in other words, the brace or braces L^1, are inclined at an angle of forty-five degrees from the intersection of the lines of the outer side of the rail stem, and the under side of the thin outer lip produced, but this angle, and its position, may be varied to suit the assumed lateral thrust of the passing load. The base of the base-bearing piece of fig. 14, abuts against the rounded portion of the rail base, and is here made concave to fit the same; it therefore acts as a retaining piece to the rail base, when properly spiked down by one or more spikes to the cross tie, while its broad base (in this figure equal to the rail's height) gives an ample bearing-surface for the load of passing trains. This design is for cast iron, having a web *a*, of suitable thickness at the middle of its length inside, which acts also to hold down against the rail base; by omitting this web *a*, the brace-bearing piece may be made of rolled iron, cut into suitable lengths, and its sections may be tightened to suit the change of material. This brace-bearing piece is held down to the cross tie by a spike G^1, the head of which is driven into a notch, and countersunk into the edge of the base K.

The hold-down spike will confine the brace-bearing pieces in position to the side of the rail, and the projecting thin lips of the rail's head will prevent the possibility of its escape while throwing upon it, during the passage of the trains, its full share of the rolling load. From six to eight inches base on each cross tie (or even more, if desired) can thus be readily obtained by the use of these artificial base pieces or brace-bearing pieces in conjunction with the Z-rail, and they are self-retaining and self-adjusting.

Figs. 11 and 13, represent the combined double-headed and flat-footed rail, or the reversible Z-rail, with the improved wedge bolt for securing the joints of the rails together, and the rails themselves to the cross ties or sleepers. A, are the rails. On the inside or inner rolling face of this rail A, is a fishing bar or splice E^1, introduced between the heads C, B, of the rail at the rail joint, having its inner face, or that nearest the stem of the rail, concave with its outer surface in a vertical plane at right angles with the base of the rail; the upper and lower edges of this fishing bar E^1, are rounded off, so as to conform to the shape of the inside of the heads of the rail, and so that, when the fishing bar is clamped in place, it will serve as a solid support for the inner lips of the rail's head; at the same time it will present lightness and compactness. On the opposite side of the rail, and between the thin lips of the rail's head and the rounded lips at the rail base, is a rectangular bracket E, the vertical position of which serves as a support for the thin lip of the rail on the

outside, to prevent it from being broken down, and that portion at right angles to it serves as an artificial base to the rail. This bracket is fitted to the outside of the rail, as represented by the figures above referred to, and is of the same length as the fishing bar E^1, on the opposite side of the rail joint.

These parts—the fishing bar and bracket—are now clamped to the rail, and, in the same operation of clamping, are secured down to the sleepers at the rail joints in the following manner:—T, is a flat wedge bolt, of wrought iron or steel, with a hole for the reception of the gib-shaped piece (or pieces) *b*, the wedge key *c*, and the spike G^1. The bolt T, passes transversely through the fishing bar, rail, stem, and bracket, and is fastened from the outside of the rail. The slot in the rail stem, through which the bolt passes, is made slightly longer than the width of the bolt, so as to allow for expansion and contraction. One of these bolts through each rail end is considered quite sufficient, although the length of the fishing bar and bracket may be such as to admit of two bolts on each side of the rail joint, should it in any case be found necessary. In securing the parts together, the rails are laid upon the sleepers in their proper position, with the bracket and fishing bar placed on each side of the rail joint, as before stated; the bolts are then passed through from the inside of the rail and the jib-shaped piece *b*, first introduced through the hole in the bolt, and brought up so as to abut evenly against the outer surface of the bracket; this piece *b*, is made tapering from its lower end. The wedge key *c*, is next introduced; this key has only one of its sides tapering, the other side being vertical, so that the spike may be driven perpendicular into the sleeper. This spike is then driven down through the hole in the bolt into the wooden sleeper, through a hole punched through the base of the bracket E, carrying with it the wedge key *c*, and clamping the parts securely together, and retaining the wedge *c*, securely in place by the head of the spike, as shown, and confining the whole to the sleeper. The joints may be readily tightened up (should they become loose from any cause) by driving the spike G^1; and the hooked head shown upon the spikes in all the figures, allows for the withdrawal of the spike and a ready separation of the parts.

Another mode of securing the joints of railway-rails is by locking the nuts of ordinary rail bolts. This mode is shown with the Z-rail recessed into the cross tie, and having angular brackets, or a bracket and fishing bar on either side of, and between the heads of the rails, or between the lips of the head and base under the table. The bolts pass laterally through these brackets or fishing bars, and through the rail stem, and receive nuts on their ends for rigidly clamping up the parts. The invention is shown as applied to the Z and T-rail, but it will be obvious from the following description, that it is applicable to all varieties of rails where bolts can be used.

In fig. 1, A, represents the Z-rail recessed into grooves in the cross ties, and confined at the joint by rectangular knee brackets E, or a rectangular bracket on the outside of the rail, and a fishing bar E^1, on the inside of the rail. These are clamped to the rail A, by screw bolts V, passing through them and the rail stem, two on each side of the rail joint. The brackets are confined to the cross ties by holding-down spikes G, driven into slots or notches punched through the edges of the bracket's base. The nuts of the bolts, and the bolts themselves, are locked and prevented

from turning by the nut fastenings B[1], which are inserted in the angle of the bracket pieces, and under the nuts and heads of the bolts. The nut-guards themselves are retained under the nuts, and are kept in place by the holding-down spikes G, the heads of which abut against them. The abutting face of the head of the rail spike is slightly bevilled downwards, and rounded off horizontally, as will be herein-after described. The nut-guard B[1], is prevented from moving longitudinally by means of recesses corresponding to the shape of the spike head into which the heads of the spikes are driven.

The patentee claims, "First,—the reversible Z-rail, and the manner of applying the same as herein set forth. Second,—the brace-bearing pieces placed outside, against the side, and under the head of the rail on the intermediate cross ties, for givingan artificial width of base to the rail at these points, so that the downward and outward pressure of the rolling load upon them will be transmitted through the outer projecting lip of the rail's head, as herein shown. Third,—the manner herein set forth of securing the joints of railway rails by wedge bolts in place of ordinary screw bolts. Fourth,—locking the nuts of rail bolts by means of a piece of metal or of wood, or of other suitable material inserted between the nuts of the bolts, the angle of the bracket or side-piece, and the heads of the holding-down spikes, as set forth. Fifth,—the improved railroad spike herein shown and described."

To JAMES MAUDE *and* LORENZO TINDALL, *both of Sherwood Iron Works, Mansfield, Nottinghamshire, for a combined garden roller and seat.*—[Dated 17th February, 1860.].

THIS invention relates to a novel mode of constructing garden rollers; the object being to remove the necessity for stowing them away out of sight when not in use, and to render them both useful and ornamental furniture for gardens when not employed in lawn or path rolling.

In Plate VII., fig. 1, shows, in side elevation, and fig. 2, in front view, a novel combination of garden roller and seat or chair. *a, a*, is the roller, cast in iron, as usual, or it may be made of solid stone if thought desirable. Secured to the axle *b*, of the roller is the handle *c*, which is formed of open work, wrought in cast iron to constitute a broad back for the seat *d*. This seat, it will be seen, is placed immediately over the roller, and is connected by stays or bracket pieces *e*, of cast iron to the axle of the roller and to the handle *c*. The seat *d*, may be made of either wood, metal, or other suitable material, and it is fitted with arms *f, f*, thus constituting a comfortable garden chair. Cast in one with the bracket pieces *e*, are two stays *e**, which project forward from the roller axle in the same direction as the seat, for the purpose of carrying an oblong or other shaped balance weight, extending in front of the roller along its whole length and parallel therewith. This balance weight forms a foot-rest *g*, for the occupants of the seat, and it balances the handle when the implement is used simply as a roller. Cross tie rods *h, h*, are provided between the seat and the foot-rest, for giving stiffness to the structure. When required to be brought into action, the roller is drawn forward in the usual way by the handle (the back of the chair), which is then depressed to bring it into the line of draught. After the rolling

operation is performed, the implement is to be drawn to any convenient part of the garden for placing a chair. The handle being then released, it will rise to the position shown, when the balance weight will rest firmly on the ground in front of the roller, and the implement may be conveniently used as a garden chair. To prevent ladies' dresses being soiled by touching the roller, wire-work is applied between the seat and the foot-rest, as shown at fig. 2.

The patentees claim, "adapting a seat to a garden roller, in the manner and for the purpose above described."

To WILLIAM EDWARD NEWTON, *of Chancery-lane, for improvements in digestors for dissolving quartzose rocks,—being a communication.*—[Dated 22nd February, 1860.]

THE figure in Plate VII., shows in longitudinal section the improved digestor forming the subject of this invention. *a*, is a cylindrical iron vessel, and *b*, a hollow shaft passing through the centre of the vessel *a*, and rotating in a stuffing-box *g*, and a journal *k*, to aid in supporting the heads of the cylinder *a*. There are arms *d, d, d*, secured to the shaft *b*, for carrying a scraper *e*. This scraper is a strong narrow steel blade, and it is intended to move the silicates from the iron bottom, to which they would otherwise firmly adhere, during the process of solution. To each of the arms *d*, is also attached a hollow pipe, communicating with the interior of the shaft *b*, for the purpose of conveying jets of superheated steam under and among the charge contained in the digestor. Steam is first taken from a common boiler, and superheated, on its passage, by any of the usual modes, and conducted into the hollow shaft *b*, through a coupling-pipe *f*, whence it will pass down the arms *d, d, d*, and be discharged in the form of jets. To the shaft *b*, is given an alternating or rocking movement, by means of a lever *c*, keyed thereto; so that the scraper *e*, moves backwards and forwards. *j*, is the man-hole, through which the charge is received into the vessel *a*; and *i*, is the discharge faucet, of large dimensions, to run off the liquid flint as soon as the solution shall have been perfected, which operation requires about two hours from the time the silicious charge is put in along with the water at the man-hole *j*. In one end of the vessel gauge-cocks are fitted.

The patentee claims, "fitting the digestor with a swinging scraper, whose shaft and arms constitute pipes or passages for the introduction of superheated steam into and among the charge, as herein described."

To ALBAN ANDERSON, *of Lancaster, State of Ohio, U.S.A., for an improvement in governors of motive-power engines.*—[Dated 28th February, 1860.]

THIS invention relates to an arrangement of mechanism for setting in regular motion a disc and the frame which supports it, and obtaining therefrom a force of sufficient power to work the regulating valves of an engine, and sensitive to an increase or diminution of the velocity of the engine. The invention also relates to a means of adjusting and regulating the force or power so obtained, so that it may be applied as a

governor to steam or other engines or machinery, and to control and regulate valves for cutting off steam where it is used expansively, and to other analogous objects and purposes.

The figure in Plate VII., is an elevation of the governor. The machine moves upon a base, which may be formed to suit convenience. *c*, is a bevil-wheel, supported by a suitable number of arms, extending from a hub or nave at bottom; *b*, *b*, are arms of a revolving frame; *h*, the yoke; *k*, the driving-shaft that turns in the bearing *d*, and on which is mounted a bevil-pinion; *r*, is a universal joint, connecting the driving-shaft with the disc *g*; *l*, is a shaft, to which the disc is fixed, and is connected by a universal joint with the driving-shaft *k*; *o*, is a sliding bush, which receives the pivot of the shaft *l*. The disc *g*, is rotated by the universal joint from the shaft *r*. *q*, is a joint for making attachments to the valve of the steam-engine, and which attachment may be effected by means of a rod or lever; *i*, *i*, is the attachment of the yoke *h*, to the joint *q*; *v*, is a flat counteracting spring, to act on the disc *g*, and bring it to its normal position; *x*, *x*, are arms which support the spring *v*.

The spring *v*, or its equivalent, is a necessary part of the machinery, but the particular manner of adapting or placing it must be determined by convenience or the position of the several parts. It may be attached to a different part of the engine or directly to the valve, or a weight may be substituted for it.

When the machine is at rest, the spring *v*, acting upon and through the arm *i*, *i*, inclines the disc *g*, toward the side to which the yoke *h*, is attached, as shown by the dotted lines *x*, *x*, so that it lies at an angle of about forty-five degrees to the perpendicular. But when the frame *b*, and disc *g*, are put in motion by the rotation of the pinion *p*, the disc *g*, rises to a vertical position, at which it should be adjusted to remain while the engine is working in a regular and proper manner and speed.

If the motion of the engine be increased, it increases the velocity of the frame *b*, and disc *g*, which tends to turn the disc from its vertical position to the side opposite the yoke, as shown by the dotted lines *y*, *y*; and by reason of the leverage given by the attachments *i*, *i*, which connect the yoke *h*, with the joint *q*, the rod which connects the joint *q*, with the valve is drawn upon and moves the valve, and cuts off the steam. When the speed is sufficiently reduced, the disc *g*, gradually moves back to its normal position, in which it is assisted by the spring *v*.

It will be evident that an apparatus, such as that above described, may be adapted either to act on the supply valves of the cylinder of a steam, air, or gas engine, or to cut off or regulate the supply of any other motive agent, whereby motive-power engines are or may be actuated.

The patentee claims, "constructing governors, as above described."

To WILLIAM EDWARD NEWTON, *of Chancery-lane, for an improved mode of attaching tools to handles,—being a communication.*—[Dated 9th March, 1860.]

THE object of this invention is to attach picks, axes, and other similar large and heavy tools, to their handles, without having an eye made through them, as hitherto, to receive the handles; thereby avoiding the loosening of the handle, by the shrinking of the same, and the weakening

of the tools. The invention also admits of the use of one handle for several tools.

In Plate VIII., fig. 1, is a transverse section of a pick attached to its handle according to this invention. Fig. 2, is a longitudinal sectional view of the same. Fig. 3, is a section of an axe, attached to its handle according to the present invention; and fig. 4, is another sectional view of the same. In carrying out this invention, the tool may be encompassed transversely by a stirrup, to form a socket to receive the handle, or a socket may be forged and permanently connected with the tool. In figs. 1, and 2, the pick A, is constructed in any of the usual or known forms, with a recess *a*, in its upper surface, to receive a metal stirrup B, which extends down each side of the pick a requisite distance, to form a socket to receive the end of the handle C, which may be of the usual form. The stirrup has a hole *b*, made through each side of it, to receive a wedge and key *c*, and *d*. The end of the handle C, which is fitted in the stirrup or socket B, has a metal strap or head *e*, attached to it, the outer end of the strap or head abutting against the inner side of the pick, within the stirrup or socket. The handle has a hole made through it, to allow the wedge *c*, and key *d*, to pass through, which causes the tool and handle to be firmly secured together. The wedge, by being driven in, draws the end of the strap or head *e*, firmly against the inner side of the pick. In certain cases, if necessary, a pin may be formed on the end of the strap or head *e*, to fit in a corresponding hole in the inner side of the pick, or a hole may be made in the end of the strap *e*, to receive a pin *e**, at the inner side of the pick.

The above forms a very good fastening, and the pick is not injured or weakened in any way in forming the fastening or connection. There are certain tools, however, in which the stirrup B, would be objectionable; as, for instance, in axes, and many cutting and riving tools, which require to have smooth sides to admit of their ready passage through the clefts made in riving and splitting. In tools of this class, sockets are formed directly on them, being forged separately, or forged and then welded; a projection *g*, extending down at each side of the tool, at its inner edge, as shown at fig. 3. These projections *g*, have each a hole made in them to receive a key *i*, and a wedge *j*. The handle D, of the axe is (like the handle C, of the pick) provided with a metal strap or head *k*, secured to it by bolts *l*; the strap or head extending down a requisite distance at the front and back side of the handle, as shown in fig. 4. The key *i*, is fitted in the lower parts of the holes *h*, the wedge *j*, being driven in over it, and bearing against the under side of the strap or head. By this latter described mode of forming the sockets, the sides of the axe are equally as smooth as those of the usual construction, the objection attending the previously described stirrup when applied to cutting tools being fully obviated.

The patentee claims, "the mode herein set forth of attaching tools to handles."

To JOHN HENRY JOHNSON, *of Lincoln's-inn-fields, for improvements in the insulation of submarine electric telegraph wires,—being a communication.*—[Dated 17th January, 1860.]

THIS invention relates to the use, in the insulation of submarine electric

telegraph wires, of a new compound substance, offering the advantages of great flexibility and elasticity, and less liability to be softened by heat, than the materials now employed; whilst, at the same time, a better insulation is obtained.

The compound is made of pulverized silex, glass, or other absolute non-conductor of electricity, mixed with india-rubber and sulphur, and subsequently vulcanized. Or pure unvulcanized india-rubber, without sulphur, may be used, mixed with pulverized silex, glass, or other non-conductor, in suitable proportions. The improved insulating compound is prepared by first thoroughly grinding or masticating the india-rubber and sulphur, and adding thereto a quantity of silex reduced to a fine powder. The ingredients should be thoroughly incorporated and uniformly mixed. The proportions preferred are twenty parts, by weight, of india-rubber, five parts of sulphur, and seventy-five parts of powdered silex. The powdered silex is obtained by grinding pure quartz in a mill, in the manner commonly practised by manufacturers of porcelain. The compound being prepared as above stated, is in readiness for the vulcanizing process, which is conducted in the ordinary manner, the degree of heat being such as to allow the resulting substance to be sufficiently flexible when applied to the conducting wire or wires of a telegraph cable. This compound will not soften at a lower temperature than 300° Fahr., and is much more flexible than gutta-percha. It is to be applied to the conducting-wire, either by drawing or forcing it through suitable apertures, by winding the wire with spiral fillets, by passing it through grooved rollers, or in any other convenient manner. In some cases, the sulphur and the vulcanizing process may be omitted, and the insulating compound may be made simply of pure india-rubber and fine silex, in the proportion of twenty-five parts of india-rubber, and 75 parts of silex, which proportion may be varied, so as to change the specific gravity of the mass, or give the insulated wire a greater or less degree of flexibility.

The patentee claims, "the application and use to and in the covering of the conducting wires of electric telegraph cables, of a compound made of pulverized silex, glass, or other non-conducting material, mixed with india-rubber and sulphur, and subsequently vulcanized, or of a compound made of pure or unvulcanized india-rubber and powdered silex, as described."

To ALEXANDER WATKINS, *of the Strand, for improvements in timekeepers.* —[Dated 3rd February, 1860.]

THE object of this invention is to dispense with the use of several parts hitherto employed in the construction of watches, chronometers, and clocks, and thereby to effect an economy in their manufacture, as well as diminish their tendency to get out of order.

In Plate VIII., fig. 1, is a plan or horizontal view (looking on the top plate) of a watch constructed according to this invention; fig. 2, represents the pillar-plate with the safety click inserted therein; fig. 3, is a section, and fig. 4, an elevation, of the box or barrel which contains the mainspring; fig. 5, is an edge view of the main-spring; and fig. 6, represents the escapement-wheel, escapement, and balance. *a*, is the ordinary top-plate; *b*, the balance-cock; *c*, the improved solid pillar-plate. This

plate is solid throughout, with only a slightly hollowed rim to receive the dial. It will be seen, on reference to fig. 2, that this plate carries several of the pivots or arbors of the movement which have hitherto been carried by separate cocks or pieces of metal. It also dispenses with the necessity for any cavities beyond that shown, and one for the minute-wheel; *d*, is the box or barrel which contains the tapered or adjusted main-spring *e*. In fig. 3, is shown the collar *f*, on the winding arbor, to which the inner or deeper, and thicker end of the spring is fixed; and in fig. 4, is shown the outer or smaller, and thinner end of the spring screwed to the outside of the box or barrel. In fig. 3, is also shown the concavity of the boss of the box or barrel, giving increased length for winding.

The degree of narrowing of the spring should be about one half of its depth in the whole length, and the decrease in its thickness from the larger to the smaller end is gradual throughout the whole length; *g*, is the safety click for the ordinary ratchet on the winding arbor. It will be seen that this click is composed of a slight spring, continued in the form of a stronger segment of metal, which is screwed to the pillar-plate *c*, and terminates in a fixed stop for the head of the click to rest against. The spring has a ratchet-tooth or teeth on the end of it, which, when disengaged from the teeth of the ratchet-wheel, rests against this stop, by which means the spring is relieved from the pressure caused by the action of the main-spring, to which it would be otherwise exposed, and is not required to be stronger than is sufficient to carry it into the spaces of the ratchet-wheel after it has been pushed outwards by the teeth thereof. The form of the click may be varied from that shown, provided it be arranged so that the head may rest against a fixed stop, and thus relieve the spring. *h*, fig. 6, is the escapement-wheel, and *i*, is the escapement. On reference to this figure, it will be seen that the centre of the wheel *h*, the pivot of the escapement *i*, and the centre *k*, of the balance-staff are in a direct line. By this means, the leverage with which the pallets *l*, and *m*, are acted on by the wheel *h*, will be equal: the distance from the roller-pin or from the notch of the fork to the pivot of the escapement *i*, is also equal or nearly equal to the distance from the said pivot to each pallet. This form of the escapement *i*, in one piece, admits of the watch being made flatter than usual. *n*, is the regulating toothed segment acting in a pinion *o*, to which is connected the index lever *p*, which has a long range over the arc *q*. By this means much facility will be given for timing, as by moving the index *p*, over the arc *q*, the pinion *o*, will be caused to move the toothed segment *n*, through a much smaller space than that traversed by the index lever.

The patentee claims, "First,—the combination or arrangement of parts in the construction of timekeepers, as described. Secondly,—the use of solid pillar-plates in the construction of timekeepers, in the manner described, for the purpose of simplifying the construction of such timekeepers, by dispensing with several parts generally used in the construction thereof. Thirdly,—the application of a tapered main-spring, combined with, and fixed within, a barrel having a toothed rim around it, as described, for the purpose of equalizing the force communicated to the train by the spring, without the aid of the ordinary chain and fusee. Fourthly,—a safety click, in which the head of the click rests against a fixed stop, so as to relieve the spring of the click from the pressure caused by the action of the main-spring, as described. Fifthly,—the use of an escapement, the two

pallets and the other arm of which are of equal lengths; and also the arrangement of the escapement in connection with the balance and the escapement-wheel, so that the pivot of the escapement, and the axles of the balance and of the escapement-wheel shall be in one straight or direct line, as described. And lastly,—the compound regulator, in which a toothed pinion, moved by an index lever, acts upon a toothed segment fixed at the end of the arm of an ordinary regulator, so as to obtain greater nicety in the adjustment of the regulator, as described.

To Jean Auguste Hilarion Ballande, *of Paris, for an improved paper and ink for writing and printing purposes.*—[Dated 13th February, 1860.]

This invention consists, firstly, in impregnating the surface of any suitable white paper, or in introducing into the pulp from which such paper is to be manufactured a suitable quantity of protochloride of mercury (calomel); in both cases, the protochloride is mixed up with any suitable thickening agent, such, for instance, as glue, isinglass, gum-senegal, or other suitable gum dissolved in water, the quantity of the thickener, in respect to the water, depending on the degree of fluidity which the liquid is to possess for keeping the protochloride properly suspended therein. The liquid is to be applied on the surface of the paper by means of a brush, in such quantity that the paper will be provided with about 4 to 8 per cent. of its weight of the protochloride of mercury. When the protochloride is to be mixed in the pulp from which the paper is to be manufactured, a much greater quantity of the protochloride is required, viz., from 20 to 30 per cent. in weight of the pulp in the dry state, a considerable quantity being in this case lost during the manufacture of the paper, which is not the case when applying the protochloride on the surface of the paper. The paper having thus been properly impregnated on the surface with the protochloride, the same is dried, and properly pressed and calendered, and is then ready for use.

The ink to be made use of for writing or for printing on this prepared paper, is composed of hyposulphite of soda and alum, or any other suitable alkaline chlorhydrate, carbonate, or sulphate, such, for instance, as sal-ammoniac, carbonate of ammonia, sulphate of soda, sulphate of ammonia dissolved in water containing a sufficient quantity of any suitable thickener, such as glue, isinglass, gum-senegal, tragacanth, or other suitable gum, which quantity is to vary according to the degree of fluidity the ink is wished to possess. For writing ink, the inventor takes the following proportions:—Gum-water, 1000 grains, alum (either alone, or mixed in any suitable proportions with one or several of the above-mentioned alkaline salts), from 40 to 60 grains, hyposulphite of soda, from 25 to 50 grains. When the ink is to serve as a copying ink on to the prepared paper, there is added to the ink from 50 to 70 grains of phosphate of lime, or any other suitable salt of lime, for every 1000 grains of the ink.

From what has been stated, it will be evident that the prepared paper, and writing or printing liquids, cannot be used but in combination with each other, and that the invention not only presents a new application of well-known chemical agents, but gives rise also to two distinct actions on the part of these agents, viz., the spontaneous formation of the dark coloration by the action of the hyposulphite of soda on the protochloride of

mercury, but which coloration would soon fade, if not aided by the action of the alum or other alkaline salt by which the dark colour becomes fixed on the paper. This fixation is said to be so perfect, that when the protochloride of mercury has been mixed with the pulp during the manufacture of the prepared paper, no chemical means known to the inventor will remove the writing or impression from the paper without visibly altering its texture.

The patentee claims, "providing paper with a sufficient quantity of protochloride of mercury, in such manner, that when writing or printing thereon with any of the above described colours, or nearly colourless alkaline liquids, dark-coloured marks or impressions will be produced and remain on the paper."

To LEWIS JOHN THOMAS HOWARD *and* LEWIS HOWARD, *of West-street, Bethnal-green, for improvements in the fabric or material used for bolting or sifting flour and other matters.*—[Dated 13th February, 1860.]

IN the manufacture of fabrics for sifting and separating materials, the patentees employ, as the weft and warp, glazed cotton threads, known under the denomination of sewing cotton. These are arranged and woven in the ordinary manner, the thread being used of a strength and size according to the nature of the fabric to be woven. The fabrics may be woven in the double or cylindrical form, in which they are used as bolting cloths, or in a flat web, and afterwards cut therefrom, and applied to the bolting machine, or for the purposes of sieves, as may be required.

The fabrics of glazed cotton thread are manufactured, either plain or strengthened, at points about an inch apart, in order to prevent them rending beyond those points. If it be so strengthened, two or three coarser threads are introduced at those points, or the shuttle is traversed two or three times in the same shed, to produce the strengthening parts of the weft, while the warp is similarly strengthened by passing two, three, or more of the warp threads, of the same fineness, or coarser, through the same heddle, at the points desired. To prevent clogging the reed of the loom, instead of passing these additional threads through the same opening therein, they may be distributed through two or more openings, so that there would be but a double quantity of warp through two or three adjoining openings of the reed, at the points of the fabric to be strengthened.

Having woven the fabric of glazed cotton thread, they then proceed to dress it with a solution of gum, using about one pound of gum to every gallon of water, and mixing therewith about one ounce of turmeric. The fabric is immersed in this solution, and, after all superfluous solution is removed, it is stretched and dried in a suitable frame, it is then fit for use. The fabric so manufactured, is of hard firm texture, is little subject to fraying or clogging while in use, and is, moreover, of a durable and consequently inexpensive character.

The patentees claim, "the manufacture of bolting or sifting cloths, or fabrics of glazed cotton thread, as also the treatment of such fabrics with a solution of gum, as described."

To Michael John Haines, *of Stroud, for improvements in the manufacture of driving straps.*—[Dated 14th February, 1860.

This invention consists in cutting leather or hides into narrow strips or fillets, each strip or fillet being of the thickness of the intended driving strap, and placing the same side by side, with the cut edges of the leather or material coming to the upper and under surfaces of the intended driving strap, until the desired width of strap is obtained. In arranging the strips side by side, care is taken that the ends of the several strips or fillets come at a distance from each other, so that the strips or fillets break joint, in order that the strap may not be weaker in one part than in another. In order to connect together the several strips thus laid side by side, they are pressed together, and holes are bored through them at intervals, from edge to edge of the driving strap; the strips may then be fastened together by introducing lengths of iron, copper, or other wire, having a head formed at one end through the holes, and then turning over, clenching or rivetting the other ends of the wires. Or the several strips may be united together by screws screwing through the holes in the several strips; the screws being screwed into the holes alternately, first from one edge of the strap, and then from the other, so that the heads of half of the screws will be on one edge, and the heads of the other half will be on the other edge. The several strips may also be connected together after that holes have been made through them as above described, by means of copper or other wire,—two wires being employed for this purpose, and both wires being passed in opposite directions through each hole, and each wire, after it has passed through one hole, being bent round and passed through the next hole, and so on; or, in place of wire being employed, the several strips may be sewn together, as above described, by means of twine or any other material.

The patentee claims, "manufacturing driving straps, as herein described."

To Henry Widnell, *of Lasswade, County of Edinburgh, for improvements in the manufacture of embossed cut-pile fabrics.*—[Dated 16th February, 1860.]

This invention consists in combining the process of embossing with that description of cut-pile fabrics, wherein printed or parti-coloured yarns are used for producing the ornamental patterns of such fabrics, and the process of embossing such cut-pile fabrics is so conducted as to leave, or for the most part to leave, the printed ornamental cut-pile portions or parts of a fabric in relief or unembossed, whilst the surrounding or contiguous ground of the face of the fabric is embossed or pressed below the ornamental parts of the face of the fabric in each case.

In carrying out this invention, a cut-pile fabric, with a pattern in different colors on its face, is produced by using printed yarns for the pile-warp of the fabric, or for a part thereof, if the pattern is in stripes running lengthways of the fabric. When the pile-warp is of worsted, the fabric is similar to that known as Utrecht velvet, except that it has a parti-coloured pattern upon it. This fabric is then embossed in the same manner as Utrecht velvet and other similar fabrics have hitherto been

embossed; the pattern of the embossing being adapted to the woven pattern. In some cases, the whole of the ground of the pattern is embossed or pressed down, or, by embossing, a second pattern on the ground of the woven pattern is introduced. The pattern on the embossing block should, however, be so arranged, that no exact joining up of the pattern shall be required at the edges of the block; as in weaving figured fabrics from printed yarns, it is difficult to regulate exactly the length over which the pattern extends; and it is necessary, in placing the embossing block on the fabric, to set it to the coloured pattern thereon by register pins or otherwise. A gum or dressing is applied to the fabric, as is usual in embossing such fabrics. Embossed cut-pile printed warp fabrics, with a pile warp of silk or cotton, may be similarly produced.

To William Henry Elkin, *of Belvedere-road, for improvements in window frames and sashes.*—[Dated 16th February, 1860.]

This invention consists in a peculiar arrangement of the parts of windows and their appurtenances, whereby the sashes or shutters are maintained fixedly in their position without rattling, and by which the sashes or shutters can at any time be removed for the purpose of readjustment or repair, without disturbing the paint or injuring the woodwork. The portion technically called the pulley-style is made loose, being kept in its place and pressed equably against the sash or shutter by means of springs at either end of it. One or both of the pulley-styles may be thus fitted, but it is found in practice that the purpose is sufficiently answered by making only one of the pulley-styles moveable. Sashes and shutters made on this principle may be used with or without weights and pulleys, according to the size and character of the window. If fitted with weights and pulleys, the sash-line is hooked over a screw-head or button fixed to the sash or shutter, instead of being nailed to the sash, as is at present universally done.

The removal of the sash or shutter is effected by pressing it sideways against the spring pulley-style, which yields sufficiently to allow the sash to be disengaged from the beads of the opposite pulley-style. The free side is then drawn inwards, and the other side of the sash liberated from the beads of the spring-style. In cases where a sash-line is used, the same is then unfastened, and the sash or shutter is disengaged. The pulley-style may also be easily taken out of the frame to repair the weights or lines.

To Thomas Barnabas Daft, *of Tottenham, for improvements in coating iron.*—[Dated 28th January, 1860.]

This invention consists in coating iron with sulphurized and cured india-rubber. For this purpose, the surface of iron is freed by acids or otherwise, from oxidation; and sulphurized india-rubber is then applied, so as to exclude the air from between the surfaces, and is retained under pressure, while submitted to the process of vulcanization or curing, by which perfect adhesion is effected between the surface of the iron and the cured india-rubber.

When it is desired to coat sheets of iron, so as to render them suitable for sheathing ships, take sheet-iron of a suitable size and gauge, say 4 feet by 14 inches, and of a gauge equal to 24 oz. per superficial foot, and having cleaned the surface, place the iron between two thin sheets of sulphurized india-rubber large enough to allow of the sheet of iron being hermetically sealed up by uniting together the edges of the sheets of india-rubber projecting beyond the edges of the sheet of iron. Before performing the operation of sealing up the iron sheet, it is necessary to get rid of any air that may be between the sheet of india-rubber and the iron, by rubbing down the india-rubber on to the iron from the centre of the sheet outwards; or the air may be removed from between the india-rubber and the iron by passing the sheet of iron, together with the sheets of india-rubber, between rollers. The projecting edges of the sheets of india-rubber are then pressed together, so as to unite them together, and enclose the sheet of iron. Having prepared several dozens of these hermetically encased sheets of iron, place them all between suitable plates of iron forming parts of a press, taking care to interpose between each layer of combined iron and india-rubber a sheet of ordinary tinned iron or other separating medium, by means of which, after vulcanization, they may be easily separated. Then bring the iron plates of the press in close contact with the pile of sheets between them, and cramp them as tight as possible, that is to say, to cause a considerable pressure of the sheets of india-rubber upon the iron, and submit the whole to the vulcanizing process, which is well understood. After the usual exposure to heat, so as to vulcanize the india-rubber, the india-rubber is perfectly attached to the sheet iron.

To produce an elastic washer, to be used with the ordinary bolt or nut, in order to prevent the nut getting loose by vibration, the following is the process:—Take two iron washers, and clean them as before described, and cut out, by punches or otherwise, a washer from india-rubber prepared for vulcanizing, and place the same between the metal washers; then put the three together on to a bolt made to fit the washers, and proceed to place as many more pairs of iron washers, with the rubber between them, as will go upon the bolt; at the end of which, screw on the nut as tightly as may be necessary to exclude the air between the rubber and iron washers, and bring them into close contact. Then bind up the outside of the washers with canvas or cloth, for the purpose of keeping the india-rubber from oozing out during the vulcanization. Place a number of such bolts charged with washers into the vulcanizing chamber, and the india-rubber, in the process of vulcanization, will adhere perfectly to the washers. When coating the exterior of articles of iron of a circular, oval, or other like section, after the iron has been cleaned and coated with prepared india-rubber, the india-rubber may readily be kept in contact with the iron during the process of vulcanization, by being bound round with tape or other material. From the examples above given, a workman will readily be able to coat other articles of iron with vulcanized india-rubber.

The patentee claims, coating iron with sulphurized or cured india-rubber, as described.

To HENRY HODGSON, *of Ballyreine, Ireland, and* PATRICK MOIR CRANE, *of Athy, Ireland, for improvements in manufactures from peat.*—[Dated 30th January, 1860.]

THIS invention consists in preparing from peat, in its natural state, blocks, slabs, or pieces of any size, form, or thickness, which blocks, slabs, or pieces are, when so prepared, found to be useful and economical in the construction of parts of buildings, and for various other useful purposes. The peat is cut as it is found in the bog in pieces suitable to the dimensions required to be produced, the light surface or flow peat being preferred. These blocks are placed between woven or textile fabric, woollen, hemp fibre, or other suitable material, made sufficiently open to allow the free egress of the water contained in the peat when taken from the bog. When the peat is so enveloped, it is placed between shelves, and is submitted to the action of an upright hydraulic or other press. When sufficient pressure has been applied, the water is entirely forced out, and the peat solidified and ready for drying, which is effected either by exposure to the atmosphere, or in a room heated artificially, or by any process by which the remaining moisture may be entirely exhaled. After the water is evaporated from the pieces, and they are thoroughly dry, they are to be put again between the plates of a hydraulic or other press, and extreme pressure put on them. If the product be required for use for inside work in building, such as partitions, linings, inside roofing, or for other work as a non-conducting substance, they do not require other further preparation than shaping, provided they are not to be exposed to wet. But slabs or pieces to be used for roofing (instead of slates, tiles, or other things of that natnre), are prepared to resist the wet or action of the atmosphere by steeping them in, or saturating or coating them with, some substance which will fill the pores, such as a solution of glue and alum, oil, tar, or the same mixed with sand or finely screened gravel, or other similar gritty or stony substance, and afterwards drying them. It is also desirable (where gritty substances are not used in the preparation), either to coat such as are to be used instead of slates for roofing with coal tar pitch, (in the way well understood by those who construct roofs of felt or wood) or to paint them with oil paint. By the above-described operations, a material is produced which is advantageously used as regards lightness, durability, and economy, not only for roofing and building as aforesaid, but for covering steam boilers, steam pipes, flues, and other articles or places where heat is to be retained, and not conducted or allowed to escape, or outward cold to be resisted.

The patentees claim, "the exclusive manufacture from peat of blocks, slabs, or pieces to be used for building, roofing, and other purposes, treated, prepared, or manufactured as described."

To WILLIAM GOSSAGE, *of Widnes, Lancashire, for improvements in the manufacture of certain kinds of soap.*—[Dated 13th February, 1860.]

THIS invention relates to the manufacture of hard soaps when using resin alone, or a large proportionate quantity of resin as the "goods" from which such soap is manufactured. The technical term goods is well understood by soap manufacturers, as indicating the oily, fatty, and

resinous substances which are ordinarily used with alkali for the production of soap. The object is effected by the combined use (together with such goods) of silicate of soda and caustic soda, or carbonate of soda, or of silicate of soda and a mixture of caustic soda and carbonate of soda.

In manufacturing soap, according to this invention, by the use of resin mixed with other goods, two tons of resin and one ton of palm oil are melted together in a suitable vessel; or in place of palm oil alone, to mix with the resin employed, other oily or fatty matter, or mixtures of oily and fatty matters, are used, the same being heated to a temperature of about 180°. In another vessel an alkaline mixture is prepared, consisting of two tons of solution of silicate of soda, having a specific gravity of 1,500, and twenty-five hundredweights of concentrated solution of caustic soda, containing thirty-eight per cent. of real soda; or in place of this quantity of solution of caustic soda, to the two tons of solution of silicate of soda are added three-quarters of a ton of solution of caustic soda, containing thirty per cent. of real soda and half a ton of carbonate of soda, containing fifty per cent. of real soda. The alkaline mixture is then heated to a temperature of about 210°. Into a large iron vesssel, capable of containing about ten tons of soap, the melted goods and the alkaline mixture are simultaneously transferred. When at the temperatures before indicated, the contact of the melted goods with the alkaline mixtures occasions a strong boiling to take place, and this boiling effects a thorough mixing of the materials employed, without requiring mechanical agitation to be used, and a perfect soap, which may be termed "strong soap," is thus produced. If such boiling does not occur at the commencement of the operation, the alkaline mixture should be raised to a higher temperature before being transferred to the large vessel, or mechanical agitation should be applied to the contents of such vessel, to perfect the mixing. It is preferred to allow the strong soap, thus produced, to remain in the large vessel about twelve hours, during which time its temperature becomes lowered, and it may then be transferred to frames, to become solid by cooling.

By these means, a powerful soap is obtained, suitable to be used for applications in which a high detergent power is required; but to prepare a soap for personal use, certain other materials are added to the strong soap, in order to obtain a soap of milder quality. For this purpose, a mixture is made, consisting of half a ton of bicarbonate of soda and half its weight of water, taking care that these shall be combined so as to produce a smooth mixture: this is designated as the "reducing mixture." Into a mixing vessel, capable of containing about three-quarters of a ton of soap, twelve hundredweights of strong soap are introduced from the large vessel before mentioned, and if its temperature be above 160°, it is agitated until reduced to about 160°. One and a half hundredweight of the reducing mixture is then added, and thoroughly mixed by "crutching;" after which the mixture is transferred to soap frames, to become solid by cooling.

By pursuing the foregoing directions, but using three tons of resin in place of two tons of resin and one ton of oily or fatty matter, soap may be produced by the use of resin alone, as the soap-making goods, but it is preferred to use some proportion of oily or fatty material with the resin employed.

In place of converting all the goods employed in the manufacture of

soap into perfect soap, by the direct use of concentrated solution of caustic soda without separation of lyes, and at the same time effecting the combination of the soap produced with silicate of soda, the method of operating before described can be so far modified as to convert a portion of the goods employed by the ordinary method of working (with separation of lyes); such soap is then added to the remaining portion of goods, together with the suitable proportion of solution of silicate of soda, and of caustic soda, or of carbonate of soda, and the combination is completed by the method of "close working without separation of lyes." Or the whole of the goods may be converted into soap by the ordinary method of working (with separation of lyes), and to the soap so produced, the suitable proportion of silicate of soda and of caustic soda, or carbonate of soda, may be added, to make up, or approximate to, the proportions before indicated for the quantity of goods employed. The mixture is then boiled after the manner of "close working," and the boiling continued until a sample of the product, when cooled, has attained sufficient hardness to produce soap of suitable firmness.

The patentee claims, "the manufacture of hard soaps from goods (this technical term goods being used in the sense before explained), consisting entirely, or for the greater part, of resin, which manufacture is effected by causing such goods to enter into combination with silicate of soda and caustic soda, or with silicate of soda and carbonate of soda, or with silicate of soda and a mixture of caustic soda and carbonate of soda; such combination being effected or completed by the method of operating known to soap manufacturers as close working without separation of lyes."

To RICHARD JOHN COLE, *of Chepstow-villas, Bayswater, for improvements in the manufacture of lead and other materials for pencils.*—[Dated 11th February, 1860.]

THE object of this invention is to render the lead or marking material of pencils generally slightly flexible, thereby preventing in a great measure the breaking of the points thereof. To this end, the patentee mixes lead or plumbago, after being reduced to an impalpable powder, with india-rubber in solution, or other suitable adhesive material (for some purposes it will be desirable to mix therewith a small quantity of grease or other fatty matter), and adds a small quantity of lampblack, and finely powdered coke and charcoal; these are thoroughly incorporated together and subjected to a great pressure, to divest the compound of any superfluous moisture, after which it may be moulded in suitable lengths for use. It will be necessary to press the materials thus mixed, to give sufficient solidity, as the degree of flexibility required will be very slight.

Crayons or chalk pencils, of every description and color, may be manufactured for the like purpose; using (in lieu of india-rubber) fine gelatine or gum, with the addition of a little glycerine, to prevent the gelatine or gum getting hard or crisp; and, for dark colors, a little charcoal finely powdered may be used.

The patentee claims, the manufacture of flexible marking materials, to be used in combination with the holders or cases patented by him on the 31st January, 1860.

To Samuel Rowbotham, *of Putney, and* George Harrison Bolton, *of Penketh, near Warrington, for a composite soap.*—[Dated 14th February, 1860.]

The object of this invention is to render the cleansing properties of soap of every description more efficacious than heretofore. To this end, the patentees make into a paste a solution of caustic potash, or ammonia, or other alkali, with pipe-clay, or such other like substance, and then mix the paste with any kind of soap, according to the purpose for which it is intended, and form it into bars or cakes, as required. Thus the cleansing properties are much increased by absorbing all grease and other extraneous matter.

The patentees claim, "the manufacture of a composite soap in the manner described, for the purpose set forth."

Scientific Notices.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

September 1st, 1860.

Mr. J. NEWTON, President, in the Chair.

The paper read was, "*On agricultural improvements*," by Mr. William Buckle, of the Mint.

After having spoken of the services which the steam-engine had been made to yield to the agriculturalist, and explained a bone mill, which the author had constructed, he referred to Scotland, and the wondrous agricultural changes which had there of late years been effected. "For the rapid improvements in agriculture and horticulture," said he, "we are much indebted to Scotchmen. Their intelligence and industry in reclaiming land from the sea, and in bringing wild and barren moors into rich cultivation, deserve the highest commendation. Nowhere is the happy change more apparent than on the Carse of Gowrie. There all the most recent appliances for promoting fertility have been adopted with complete success, and happy homesteads have consequently supplanted miserable cottages."

The various modes of draining and manuring employed were explained, and the triumphs of scientific cultivation pointed out. Mr. Buckle concluded his interesting address by stating that, as mechanical inventions were continually being devised for facilitating agricultural works, he should not apologise for introducing to the members the subject he had chosen for his paper. The discussion which followed the reading of the paper was carried on by Messrs. Ross, Stabler, and the Chairman.

Scientific Adjudication.

LIVERPOOL ASSIZES.

April 2nd and 23rd.

Before Mr. Baron Wilde and a Special Jury.

MAYER *v.* SPENCE AND ANOTHER.

This was an action brought for an alleged infringement upon letters patent, granted to Mr. Ewald Riepè, for an invention of improvements in the manufacture of steel, and bearing date 29th January, 1850. The Solicitor-General (Sir William Atherton), Mr. Hindmarch, Mr. Webster, and Mr. J. A. Russell, were for the plaintiff; Mr. Knowles, Q.C., Mr. Manisty, Q.C., and Mr. Aston, for the defendants.

Mr. Hindmarch having opened the pleadings,

The Solicitor-General said, that the plaintiff in this case was M. Jacob Mayer, a steel manufacturer in Prussia, and he brought this action against Mr. James Spence and Mr. Frederick Worthington, manufacturers of steel and tin plates, at the Derwent Works, Workington, Cumberland, in respect of an infringement committed by them upon letters patent, granted, in 1850, to M. Ewald Riepè, a foreigner, on a communication made to him by another foreigner. The plaintiff in this action, M. Mayer, was the assignee of M. Riepè, who had since died, and the patent had become vested in him. The patent related to the manufacture of steel in puddling furnaces, and the jury would find that the manner of manufacture invented by M. Riepè resulted in very great advantage to the manufacturers of steel. The jury would be aware that steel was iron, the carbon of which had been got rid of to a considerable extent. When the ore was obtained, the first process which it underwent was that of smelting, which consisted of melting the ore in a furnace having a tank or depressed surface, in which the fluid metal would collect. By this means, the grosser matters were got rid of, and the iron was run out, being then called cast pig or crude iron. Malleable or wrought iron was made from this crude iron in the puddling furnace, which had been used since the year 1784, when a person named Cort took out a patent for it. The puddling furnace was only an ordinary reverberatory furnace, in which the molten metal was puddled; the furnace being so constructed as to have two divisions, in the one part of which was placed the fuel, and in the other the materials which were to be acted upon; an aperture being left of sufficient size to allow the workman to introduce a bar of iron, bent at the end, and known as a "rabble," and the puddling consisted in the metal being worked about with this whilst in a state of fusion. The object in the manufacture of wrought iron was to get rid of the carbon contained in the pig iron as far as possible. This was effected by the carbon contained in the metal being brought to the surface by puddling, and exposed to the action of the atmospheric air, the oxygen of which having a great affinity for the carbon, combined with it, and so the carbon was carried off. Between the pig and the wrought iron there was an intermediate stage, which formed the substance called steel. In the

manufacture of steel, it was not desired to get rid of the whole of the carbon, but of only a part; and the object to be arrived at, and which he (the Solicitor-General) asserted Riepè had accomplished, was to be able to stop the decarbonization of the metal at the point at which sufficient carbon remained in the metal to constitute it good steel. Riepè's process was accomplished by the same puddling furnaces as had been universally used by the manufacturers of wrought iron for the last seventy years. Although the invention was both ingenious and useful, yet, like so many other inventions, it appeared very simple after it was found out. For seventy years the manufacturers and skilled workmen, who had their attention continually directed to this subject, had not accomplished it, and he thought that he should be able to satisfy the jury, that until 1850, when the patent was obtained by Riepè, no approach even to the manufacture of steel in the puddling furnace had been attained. Previous to the taking out of Riepè's patent, steel was manufactured from bars of wrought or completely decarbonized iron, and the round-about process of recarbonizing that which had previously been decarbonized had to be resorted to. The recarbonization was effected by decarbonized iron being put into troughs, made of prepared material; the various bars being imbedded charcoal, and then subjected to a very considerable degree of heat, which was kept up for some days. By this, the carbon contained in the charcoal was discharged into the wrought iron, and thus, that which had been malleable iron, became steel. Under Riepè's patent, the decarbonization of the pig iron was continued up to the point at which good steel was the result, without its being allowed to continue so long as to convert it into wrought iron; and he thought the jury would regard him as a meritorious inventor. In calling the attention of the jury to the specification of this patent, he should remark, that a part of the invention had been disclaimed. The patentee declared that the undisclaimed part consisted in a peculiar manner of working in the puddling furnace. He said, "I employ the puddling furnace in the same way as for making wrought iron. I introduce a charge of about 280 lbs. of pig iron, and raise the temperature to redness. As soon as the metal begins to fuse and trickle down in a fluid state, the damper is to be partially closed, in order to temper the heat. From twelve to sixteen shovelfulls of iron cinder discharged from the rolls or the squeezing machine are added, and the whole is to be uniformly melted down. The mass is then puddled, with the addition of a little black oxide of manganese, common salt, and dry clay." Up to this point, the process was the same as in the manufacture of wrought iron, and the inventor disclaimed everything up to this point. But he now came to that part of the specification which was new. "After this mixture has acted for some minutes, the damper is to be fully opened, and 40 lbs. of pig iron put into the furnace near the fire-bridge, upon elevated beds of cinder prepared for the purpose. When this pig iron begins to trickle down, and the mass on the bottom of the furnace begins to boil and throw from the surface the well-known blue jets of flame, the pig iron is raked into the boiling mass, and the whole well mixed together. The following part was that which it was alleged the defendants had infringed:—"The mass soon swells up, and small grains begin to form in it, and break through the melted cinder on

the surface." This was the cardinal point in the invention. It had been well known for years, that in the course of the manufacture of wrought iron, at a certain period, bubbles or grains began to appear, and continue for some time upon the surface of the molten metal. Riepè, noticing these grains, had found it possible to arrest the further decarbonization of the metal at the point at which it was steel. He proceeded—"As soon as these grains appear, the damper is to be three-quarters shut, and the process closely inspected whilst the mass is being puddled to and fro beneath the covering layer of cinder. During the whole of this process, the heat should not be raised above cherry redness, or the welding heat of shear steel. The blue jets of flame gradually disappear, whilst the formation of grains continues, which grains very soon begin to fuse together, so that the mass becomes waxy, and has the above-mentioned cherry redness. If these precautions were not observed, the mass would pass more or less into iron, and no uniform steel product could be obtained." For the succeeding portion of the operation, the damper was to be entirely shut, and part of the mass was collected into a ball; the remainder being kept covered with the cinder slacks. The ball was then put under the hammer, and worked into bars. Some considerable discussion would be raised as to the description, "cherry redness." In considering this specification, a reasonable construction should be put upon the language, not a strictly critical one. The specification said, that the heat should not be raised above "cherry redness, or the welding heat of shear steel." The phrase cherry redness, however, did not stand alone, but was coupled with such other words of description as made the meaning perfectly clear, and beyond all reasonable misapprehension or error. The words, "the welding heat of shear steel," showed clearly what was intended, and he should call persons of skill to prove that this was a sufficiently accurate description. The patentee said in his claims, "I do not claim the commencement of the above-mentioned process for making steel in the puddling furnace; but what I claim is, the regulating the heat in the finishing process, and excluding the atmospheric air from the mass, in the manner described; and also, the use or addition of iron to the mass during the latter part of the process." He (the Solicitor-General) had now to consider the question of infringement by the defendants. Now he should show that the defendants manufactured steel in a puddling furnace with colorable changes from Riepè's invention, and that they had not done so previous to 1850. The defendants had been called upon, by the order of a learned Judge, to allow an inspection to be made of the manner in which they worked, and it was from this inspection that the proof of the course adopted by them rested to-day. Mr. Campbell, Mr. Homersham, and Dr. Frankland, made the inspection on the 10th July, in the presence of Mr. Spence and Dr. Lyon Playfair, and they would describe the process which they witnessed. He thought that when the jury had heard their evidence, they would be of opinion, that the process adopted by the defendants was a mere attempt to give an appearance of difference where none really existed. The chief difference was, that instead of using the damper, they had two fires and two ash-pit doors, by the use of which they obtained the same result as the plaintiff did by the use of the damper; for whilst the plaintiff ex-

cluded atmospheric air, the defendants admitted it, but in such a way as to consume the oxygen contained in the air before it got to the metal. The defendants denied the infringement; they denied that Riepè was the first inventor; and they denied that he had properly described his invention. They said, further, that the invention was not of any use or advantage to the public. He (the Solicitor-General) contended that the invention was one of considerable utility. The defendants had also thought fit to plead that the plaintiff did not enter the disclaimer, as alleged, according to the statute, but that the leave of the Attorney-General was obtained by fraudulent allegations. He (the Solicitor-General) was at a loss to know why such a plea had been put upon the record, and he did not think it was very creditable to the defendants to have done so. It was impossible to exaggerate or to overstate the importance of this question; and it was not credible that if any of the persons who had manufactured iron in the puddling furnaces so many years, had discovered this method of making steel, they would have kept it secret, and would neither have communicated it to other manufacturers, nor availed themselves of it to make steel. The learned Counsel concluded by further stating the nature of the evidence he should call, and by expressing a conviction that the jury would find a verdict for the plaintiff.

The specifications and other documents having been put in, the following evidence was called:—

Mr. William Clay, managing partner of the Mersey Steel and Iron Works, said, I have been intimately acquainted with the manufacture of iron all my life; I am also acquainted with the manufacture of steel. The iron which is obtained from the smelting furnace is highly carbonized. There was a process invented many years ago for the purpose of converting cast into malleable iron, called the puddling process. It was the invention of a Mr. Cort. In puddling iron, a reverberatory furnace is used, and there is a fireplace in which the fire is ignited; it is next to the receptacle in which the iron to be acted upon is placed. That is covered with an arch, in order that the heat may be thrown down upon the iron below. The fire passes over the bridge and over the iron in the bed of the furnace. That is usually called a puddling furnace. In puddling, the pig iron is placed in the bed of the furnace, and is kept there until it is melted by the action of the fire, the workman then rakes it about. These furnaces usually have dampers at the top of the chimneys. In the course of puddling, as soon as the metal is melted, it is agitated with a "rabble." Towards the end of the process, the agitation caused by the bubbles of gas is very considerable. The iron is boiled by the heat, and during this process flames of a bluish color appear above the metal, and continue during the process, but gradually diminish, and what are called "grains" ultimately appear. The object of the puddler is to sustain the heat, and continue it so as to effect the perfect decarbonization of the iron. It is then taken from the furnace in balls, to a hammer or squeezer, in order to be consolidated. The metal is then wrought iron. Before the date of the patent, which is the subject of the present action, steel was made by the "converting system" or "cementation;" the object of which was to carbonize the iron. In performing that process, wrought iron was

put in a closed vessel, surrounded with carbon, and the vessel was then heated; the heat being kept up for several days. The surfaces of the metal were more carbonized than the centres by this process, and the size of the bar was limited by the size of the vessel. Before the date of this patent, I had never heard of the manufacture of steel in a puddling furnace. My attention was called to the subject in October, 1857, by an ironmaster named Fermstone, who showed me an extract from Riepè's specification, when I was induced to make an experiment on it in an ordinary puddling furnace, assisted by Mr. Fermstone and an ordinary puddler. We followed the epitome of the specification, and the result was a puddled bar of steel of very excellent quality. I have looked for the epitome of the specification given me by Mr. Fermstone, but cannot find it. I have recently looked through the specification, and the process adopted by us was exactly the same as the one there described. In the experiment, we put in 280 lbs. of pig-iron into a puddling furnace, and melted it down, and added a quantity of cinder; when the pig-iron was melted, we put in 40 lbs. more of pig-iron on a bed of cinder, near the bridge. When the metal was all melted, we put in a small quantity of manganese, salt, and clay, having previously lowered the damper to temper the heat. Shortly after, all the metal began to boil violently and to emit blue jets of flame. After this had boiled some time, we raked down the 40 lbs. of pig-iron into the mass, and a violent boiling continued for some time, and grains began to appear through the cinder. We then shut the damper three-quarters, and the grains began to agglomerate together. We opened the damper and collected a ball together, which we took to the hammer, and found from its appearance that we had got something that was not iron. We found afterwards that it was steel. The remainder of the steel was balled up in the usual manner. Our conduct, when the grains appeared, was very different from that followed for the purpose of producing wrought iron, for instead of continuing the heat, we regulated it. The heat necessary to produce granulation and the blue jets of the flame are well known. I know the welding heat of shear steel, and the heat during the granulation did not exceed that heat. The color presented by the furnace depends upon the degree of light by which it is observed. There would be an apparent difference of 500 degrees between two furnaces of the same heat looked at, the one by daylight, and the other in the dark. I and my partners took a license, and since then we have manufactured puddled steel very largely. After some experience, we found we could dispense with the final pig, but we occasionally found the final pig useful; but generally, with care and experience, we managed to do without it. The use of the final pig is to cause the iron to boil. We want various qualities of steel. If we wanted to make hard steel for chisels or tools, we should use final pig. The phrase welding heat of shear steel describes accurately the heat used, but cherry redness does not convey any definite impression to my mind. The language of the specification is sufficient to instruct an ordinary workman as to the process to be adopted, and it has done so.

Cross-examined by Mr. Knowles: My firm are not the real plaintiffs in this action. I don't know whether we are the only licensees. Report says that Messrs. Naylor, Vickers, and Co., of Sheffield, are also

licensees. I have heard of their name in connection with this cause, but I don't know that they are the plaintiffs. I don't know M. Mayer, and I don't take my license from him; but from Naylor, Vickers, and Co. We are not the exclusive licensees; but Naylor, Vickers, and Co., Mr. John Brown, and a firm in Scotland, use this process. Puddling furnaces have been used for seventy years for the manufacture of iron, and the damper is invariably used for regulating the admission of the atmosphere, and therefore of admitting or excluding the oxygen. The terms red and white heat are well-known terms. The amount of carbon contained in cast iron is from two to three per cent., according to the number of the iron. In every process of converting cast into malleable iron there is a point at which steel is obtained. The quality of the steel varies according to the point at which decarbonization is stopped. The puddling furnace is not built so as to obtain the greatest amount of heat. The greatest heat obtained during the melting process is a red or yellow heat. At the time when the mass boils, by the old process, the metal is at a white heat. I know from books that, before the date of this patent, steel was made direct from cast iron in Styria, not in a puddling furnace, but in a Catalan forge. This was making steel direct from the ore. Cinders were always used in the iron puddling process: they float at the top, and always have the effect of excluding the atmosphere from the melted mass. I know the patent of Schafhautl, the object of which is an improvement in the manufacture of malleable iron, by the introduction of oxide of manganese and other ingredients.

Mr. Knowles: Now listen to this specification. "If a harder iron for conversion into steel is required, I employ three or four shovelfulls of the slack which is used in rolling iron, and three shovelfulls of the cinder that runs out of the balling furnace." That is, he uses a larger amount of cinder, so as more effectually to exclude the atmosphere, is it not? I don't put that construction on it. The cinder is used for another object. The oxygen contained in the cinder combines with the carbon contained in the iron, and causes the metal to boil. Mr. Knowles: The harder iron is produced by the more effectually excluding the oxygen of the atmosphere? Yes . . . . And it goes on, "but if I wish to obtain still harder iron, I use the usual quantity of hammer slacks, but add a shovelfull of cinder from the balling furnace." Is not the result of that what is called puddled steel? Certainly not . . . . The hard iron is for conversion into steel, and the harder iron is also for conversion into steel. Neither of those are steel; they are a widely different material. When experimenting in making steel by Riepè's patent, we did not stop at redness, as directed in the description. The manganese and other ingredients are the same as those directed to be used by Schafhautl: in using them, we depended on our own judgment; no definite amount being specified. The damper was up when we raised the temperature of the furnace to melting heat. When the iron began to melt down, we threw in a quantity of cinder; the damper having been partially lowered. The elevated bed of cinders is put in before the process commences, and the heat which melts the metal is not sufficient to melt the cinders. The bed would require the action of a greater amount of heat. Before we commenced puddling, we put in the 40 lbs. of pig iron to make the metal boil more

completely. We constantly use the product of this operation when we want the harder qualities of iron. The heat used in the process is regulated by the experience of the puddler. Shear steel is steel piled, heated, and hammered. It does not require so much heat to weld shear steel as to melt it. I can tell the welding heat of shear steel when I see it, but I don't know the thermometric heat. Towards the close of the process, when the grains appeared, we closed the damper entirely, practically speaking, but it was not so closely shut as to prevent the egress of smoke. The balling is the finishing process, and the heat must be raised at this point to ball up.

Re-examined: Naylor, Vickers, and Co., gave us the license as the agents for M. Riepè, not as principals.

Mr. Fermstone, manager of extensive ironworks at Middlesbro', confirmed the evidence of this witness as to the specification being sufficiently definite in its description of the patent, and said the directions it gave to the workmen were ample for working it. They had nothing to do but to carry out the directions of the specification, and steel would be the result.

Mr. Dugald Campbell, analytical chemist, London, had had considerable experience in the manufacture of steel and iron. He was appointed, by order of the Court, to visit the works of the defendants, with Dr. Frankland and Mr. Homersham, to inspect the manufacture of steel. He there met with Mr. Spence aud Dr. Lyon Playfair. The furnace was an ordinary puddling furnace, except that there were two fireplaces. There was no damper at the top of the chimney, but the fittings remained to show where a damper had been. Dampers were attached to the other furnace chimneys. The furnace had been previously heated. A small quantity of cinder or slack was put in the bed of the furnace. Then a quantity of iron was put in—480 lbs., we were told; the charging door was then shut, and the ash-pit doors (the doors attached to the two fireplaces) were thrown open. The iron began to fuse, and when the charge was fully melted, it was covered with slack, and then the outer ash-pit door was closed. The result of that would be to lower the temperature. About 5 lbs. of common salt were put in. When the grains of metal first appeared, the inner ash-pit door was closed and the outer one opened. The effect of that upon the heat would not be material, but it would deprive the atmospheric air of its oxygen. A few minutes afterwards, the metal became in a waxy state, and balling commenced. Part of the charge was made into a ball, and this was removed under a hammer; the remainder being kept covered with cinder slack. This was repeated until four balls were obtained. They were then rolled, and the product was steel. He thought the product was small, but it was not weighed. The metal appeared to be wasted in the furnace by being burnt away, and witness thought the operators were unable to regulate the temperature sufficiently. He had seen steel made by Riepè's patent, and considered the process adopted by the defendants to be substantially the same. He was not aware that steel had ever been made in the puddling furnace before this patent was taken out. The directions given in the specification were sufficient for the manufacture of steel.

Cross-examined: There was never a time, during the inspection at the defendants' works, when both ash-pit doors were shut. By the

plaintiff's process, oxygen was excluded by the non-admission of atmospheric air, and by the defendants' process the air was admitted, but the oxygen was prevented from entering by being consumed in passing over the inner fire. Mr. Knowles: And do you consider these are the same processes? My impression is that the result is the same.

Dr. Frankland, chemist to St. Bartholomew's Hospital, proved that he was present at the operation described by the last witness. His impression was that the process followed was substantially the same as Riepè's, although there were differences in detail. The welding heat of shear steel was about 2700° or 2800° Fahr., and the melting heat 2900°.

Mr. S. C. Homersham, civil engineer, said he was one of the inspectors on the occasion referred to. He also considered the process, as worked by the defendants, as substantially the same as Riepè's. In cross-examination, he said he did not consider the heat white at any part of tho process. It was certainly below the welding heat of shear steel.

David Jones, steel heater, formerly in the employ of the defendants, said he worked for them at the time the furnaces were first built, when Mr. Spence took out his patent. Dampers were always used when steel was being made in the furnaces, but not when iron was being made.

William Williams, puddler, formerly in the employ of Spence and Co., confirmed the evidence of the last witness as to dampers being used at the works, and described the process adopted in the manufacture of steel.

Mr. Joseph Bramwell, engineer, said he had had considerable experience in ironworks, but had never heard of the manufacture of steel by the puddling process prior to 1850. He confirmed the evidence of previous witnesses as to the specification being sufficient to work by. He considered it to be substantially like Riepè's, with the exception of the final pig, or the 40 lbs. put in during the process. The final pig gave certainty and rapidity to the process, and assisted in cooling the mass.

Mr. E. A. Cowper, consulting engineer, Great George-street, Westminster, said he was very intimately acquainted with iron and steel. He entirely agreed with Mr. Bramwell in the evidence he had given.

This completed the case for the plaintiff.

Mr. Knowles, addressing his Lordship on behalf of the defendants, submitted that the specification was defective and insufficient; that it was contradictory in its terms, and that if its directions were followed, the product of steel could not be obtained. The patent was stated to be for an improvement in, and peculiar manner of, working in the puddling furnace. But the working in a puddling furnace was no part of the claim, because the patentee said, "I do not claim the commencement of the above-described process for making steel in the puddling furnace." It was clear to any one who read the specification, that the object was to work in the puddling furnace, and thereby produce steel at a low temperature; the notion being that a high temperature would prevent the process from being effected, because it would carry it too far, and instead of making steel, would make malleable iron. The patent was void, because it spoke of raising the tempera-

ture to redness, which was insufficient to carry out the operation, and thus it was calculated to mislead. It was admitted by the witnesses, that redness was an insufficient heat, and would have no effect at all. He wanted to know what was meant by cherry redness, or the welding heat of shear steel? It was admitted that cherry redness was not synonymous with the welding heat of shear steel, but was a much inferior degree of heat that would nòt fuse at all, and therefore the direction of this specification was contradictory and ambiguous. How was the workman to find out which description was the right one, except by experiment? From what followed, it was certain that a low degree of heat was what was in the mind of the patentee. But besides these, there were other objections to the specification. The patentee claimed, the regulating of the heat in the finishing process by shutting the damper entirely down, and excluding the atmospheric air. Now if either of these points were old, the patent was clearly a failure, and it was now in evidence that excluding the atmospheric air from the mass by the addition of cinders, was a very old process in the manufacture of malleable iron. The making of steel was exactly the same thing, only stopping at an early period, and therefore that was old, and could not be the subject of a patent. He submitted that on these grounds the patent was a failure, and could not be sustained.

Mr. Manisty also rose to urge some other objections, when

Mr. Baron Wilde said that he did not intend to nonsuit at present. He would give leave to move upon these points.

The Solicitor-General urged that the points should be clearly stated.

Mr. Baron Wilde said that it would not do to tie the defendants down to particular points.

Mr. Knowles then proceeded to address the jury, urging upon their attention certain important facts, which the evidence he should call would establish. And with respect to the allegation, that the damper was taken off the furnace when the gentlemen appointed to inspect the operation on the defendants' premises were present, he remarked that dampers were attached to all the furnaces, because they were principally used for puddling iron; but on that occasion, the damper was taken off, in order that the inspectors might see the more clearly that it was not used.

At the conclusion of the address, the Court adjourned.

On the following morning, at the opening of the Court,

Mr. Baron Wilde asked the Solicitor-General, what construction he put upon the claim which was described as "the regulating heat of the finishing process," because the case ought not to go further without some understanding as to what they were doing. What was meant by the finishing process? There were two parts of the process described to which these words might apply. One was that which spoke of the damper being three-quarters shut, as soon as the grains made their appearance, for the regulation of the heat; the other was the part which gave direction for the closing of the damper when the metal is to be made into balls. That, too, was a portion in respect to which there was a regulation of heat. He supposed the Solicitor-General would say that the finishing process applied to both of these?

The Solicitor-General said he should certainly contend that the words applied to both.

Mr. Knowles said he should contend that it referred only to the latter.

Mr. Baron Wilde said he thought of putting the case to the jury according to the plaintiff's interpretation, but if he should happen to be wrong in doing so, he should be putting the defendants to the expense of another trial. Therefore, he (the Judge) was bound to make his own selection, and to determine for himself which of the two portions the words applied to.

The Solicitor-General pointed out the reasons why he held that the finishing process commenced with the words "as soon as the grains appear, &c.," and that they were not confined to the direction as to the balling operation.

Mr. Baron Wilde said, the claim was undoubtedly ambiguous; indeed, it was doubtful whether it was not so much so as to be void, but upon that he had not now to give an opinion. In his judgment, the finishing process must be taken to apply to the latter portion, for that was the only part to which the terms could apply. If the Solicitor-General liked, he would leave the question to the jury in the form in which he (the Solicitor-General) held that it was to be understood, if he would consent to the defendants taking a verdict if he were wrong.

The Solicitor-General said, he should prefer his Lordship taking his own course in directing the jury.

Mr. Baron Wilde: What I shall put to the jury will be, whether the finishing process—that is, the balling process—is new, and whether it has been infringed?

The following evidence was then given:—

Dr. Lyon Playfair, professor of chemistry at the University of Edinburgh, said, he had given considerable attention to the subject of steel and iron, and had published a work on the subject. The average quantity of carbon in cast iron was 3 per cent.; in steel, from ½ to ¾ per cent.; and in wrought iron, rarely more than two-tenths per cent. The process of making steel from the ore had been known from the time of Aristotle—(laughter)—and from cast iron for several centuries. That had been done abroad, so far as he knew. Numerous publications had given accounts of it, a number of which he proceeded to quote. They were from the works of Baudrimont, Thenard, Dumas, Schubarth, and other foreign chemists, and they gave accounts of the manner of manufacturing steel from cast iron. Having read these, Dr. Playfair proceeded to say that he had read Riepè's patent. In his judgment, if Riepè's description were followed, steel could not be made; certainly not if the temperature there mentioned were adhered to. By the term redness, when used in scientific works, a temperature of about 1000° was understood. The temperature at which cast-iron melted was generally taken at 2700°, consequently cherry redness could not melt it. He was present at an experiment made at the defendants' works, and the account which had been given agreed with what he had noticed, with the exception that during the melting the heat of the furnace was a strong white heat. In his judgment, Spence's process with the two fires was essentially different from the plaintiff's, for the following reasons:—In Riepe's, the damper was shut down and the air excluded, and consequently the oxygen with it, the effect of this being to lower the

temperature; but in Spence's furnace, the front ash-pit was closed, the back one open, and as much air entered as before, carrying with it sufficient oxygen to keep up the temperature. This, in his opinion, was a great advantage; because, as the grain appeared, it was necessary that the slack should be well melted, to allow the grains, after they have lost sufficient carbon, to fall to the bottom of the molten mass, and because these grains were more difficult to fuse than common iron, greater heat being required. In consequence of the greater heat employed, the slack separated more readily when the ball was put under the hammer, and in that respect Spence's process had an advantage over Riepè's. Cross-examined: Some of the extracts which he had quoted referred to the Catalan furnace, the others to furnaces with a blast commonly used in Germany, but none of them described the puddling furnace. He could not tell whether "the welding heat of shear steel" was higher than "cherry redness," for want of practical experience, as he had never seen steel welded.

Mr. Calvert, professor of chemistry at the Royal Institution, Manchester, agreed with the evidence of Dr. Playfair, as to the differences between Riepè's and Spence's processes. There was no advantage to be gained by any reduction of temperature caused by the shutting of the damper, but a high heat was more beneficial than a lower one, provided the oxygen could be kept down. Steel could not be made, if the directions as to "cherry redness were followed. The heat at which steel would weld, was higher than cherry redness, but rather below the melting heat of steel.

Mr. Longridge, civil engineer, agreed with the previous witnesses as to the impracticability of Riepè's description.

Mr. Spence said, he was one of the defendants in this action. He had not made steel until about two years ago, when he became acquainted with Riepè's patent, and also took out one of his own. David Jones, who was called yesterday, had been ball furnace-man; and the other man, Williams, was only employed a few weeks at his works. He confirmed the statements made by Mr. Knowles, in his address to the jury, as to the reason for taking off the damper during the inspection, and for having dampers affixed to the other furnace chimneys. In cross-examination, he said, that he studied Riepè's specification, and attempted to work by it, whilst negociating with Naylor, Vickers, and Co., for a license. He did not, however, obtain the license, in consequence of their requiring a condition to which he could not agree. In re-examination, he said, that he could make nothing when he attempted to work by Riepè's specification.

Mr. Joseph Beezley, ironmaster, Smethwick, near Birmingham, produced a specimen of "steel iron," and said it was made by him before 1850, in the puddling furnace, and it was the same as the metal called puddled steel. He described the manner in which it was manufactured. The heat was regulated by the damper; cinder slack and "physic" were used; and the process closely corresponded with that of the patentee, with the exception that he obtained as great a heat as possible. He made some hundreds of tons before 1850, and he himself had made chisels from it. . . . . In cross-examination, he said that it was always the custom to lower the damper at the balling process, but a difference he made in the process formerly practised, was to bring

out the metal as soon as a ball could be formed, instead of waiting till the whole metal could be made into balls. The metal remaining in the furnace was not always kept entirely covered with slack, but as nearly so as possible. He was not aware, up to a very recent period, that such a patent as Riepè's existed. The process adopted by him was different, in that he adopted higher temperatures, but in other respects it was exactly the same. He had not tried to make steel according to Riepè's specification, and he did not think it possible to do so.

The Judge remarked, that he must draw the attention of the Solicitor-General to this evidence; for unless he could convince the jury that this gentleman was telling an entire falsehood, which he did not think at all possible, it was fatal to his case. The description appeared to him to embrace the whole of the patentee's process.

The Solicitor-General admitted that it was so, and that he should be confined to the balling process. He should, however, like more witnesses to be called.

Mr. Solly, of the firm of Solly Brothers, Tipton, Staffordshire, said that, before 1850, his firm made steel-iron, and described the process adopted, which corresponded with that described by the last witness. They made 4000 or 5000 tons before 1843. They had purchased the patent of Schafhautl .... Cross-examined: The hardest of the steel-iron thus made was used for making tools, but the greater part was sent to Sheffield to be converted into steel. Usually the first ball taken out was harder than that which followed. It was puddled steel, but had to be converted, because it was not sufficiently hard for the purposes to which it had to be applied. The product of the furnaces was unequal.

The Solicitor-General said that, under these circumstances, he thought he ought to allow his client to be called. Should he be allowed to move upon his Lordship's ruling as to the meaning of the finishing process?

Mr. Baron Wilde said he thought it would be fair that the Court above (Queen's Bench) should first deal with his ruling, and he made a minute to this effect—"The plaintiff to be called if the Court think that my ruling is wrong. The case is not to be sent to a new trial unless the Court are of opinion that, assuming the defendants' evidence to be true, there is still some question of novelty sufficient to send to a jury."

Mr. Manisty: Then we can practise the process as described by the specification?

Mr. Baron Wilde: Yes, certainly.

Mr. Knowles suggested that the better way would be for the jury to give a verdict upon the plea of novelty.

The Solicitor-General: Oh! but you can't force me to go to the jury. I can select to be non-suited, at all events.

The plaintiff was non-suited accordingly, it being understood that the plaintiff could apply at the Court of Queen's Bench to decide the meaning of the "finishing process,"—whether it referred simply to the regulation of the heat at the balling, as Mr. Baron Wilde had ruled, or whether it included the whole process from the time when the grains appeared.

MAYER *v.* FIRTH AND OTHERS.

THIS was a case precisely similar to the above. The defendants were Messrs. T. Firth and Sons, Norfolk Steel Works, Sheffield. The Solicitor-General said, he would have the jury sworn, and take the same course as in the last case. The learned Judge suggested that the record had better be withdrawn until the other case had been settled. The Solicitor-General said, he would have done so, but that there were proceedings pending in Chancery, and he did not wish to compromise them. He should therefore prefer to take a nonsuit. The plaintiff was, therefore, nonsuited on the same terms as in the last case. On the application of the Solicitor-General, his lordship said that of course he would stay execution.

PROVISIONAL PROTECTIONS GRANTED.

1860.

[*Cases in which a Full Specification has been deposited.*]

2019. Henry Martyn Clarke, of Boston, U.S.A., for an improved machine for grinding or reducing paper stuff to pulp, and sizing the same,—being a communication.

2021. Edward Augustus Dana, of Massachusetts, U.S.A., for an invention relating to ordnance as well as fire-arms,—being a communication.

The above bear date August 22nd.

2049. Ferdinand Gabriel Migeot de Baran, of Paris, for an improved method of stopping bottles or other vessels for containing gaseous liquids. [*Dated August 25th.*]

2100. William Scott Underhill, of Newport, Salop, for improvements in the manufacture of iron fencing or lattice. —[*Dated August 30th.*]

2164. Charles Stevens, of Welbeck-street, Cavendish-square, for an improved lavatory,—being a communication.—[*Dated September 7th.*]

2199. J. Charles de Louvrié, of Paris, for improvements in moulding without models.—[*Dated Sept. 12th.*]

[*Cases in which a Provisional Specification has been deposited.*]

1103. William Edward Gedge, of Wellington-street, for improvements in the manufacture of bolts,—being a communication.—[*Dated May 2nd.*]

1428. Vital De Tivoli, of Stanley-place, Pimlico, for improvements in civil and military ambulances. — [*Dated June 11th.*]

1602. John Johnson, of Ashton-under-Lyne, for certain improvements in jacquard machines.

1610. Thomas L. Braynard, of New York, for improvements in apparatus for working, training, and levelling cannon on board of vessels, and in fortifications, redoubts, and other places,—being a communication.

The above bear date July 3rd.

1663. François Boex, of Bruxelles, for improvements in ornamenting glass surfaces,—being partly a communication.—[*Dated July 10th.*]

1701. Samuel Cunliffe Lister, of Manningham, Yorkshire, for improvements in machines for preparing silk, flax, and other fibrous materials.—[*Dated July 14th.*]

1742. Richard Archibald Brooman, of Fleet-street, for the treatment of gluten, in order to manufacture a substance to be employed in printing fabrics and other industrial uses, in substitution for albumen,—being a communication.—[*Dated July 18th.*]

1770. William Turner and John William Gibson, of Dublin, for improvements in bridges.—[*Dated July 21st.*]

1778. Richard Archibald Brooman, of

Fleet-street, for a method of, and machinery for, goffering or impressing, coloring, and gilding, or otherwise covering with metal, leather, and fabrics, and substances in a sheet state, — being a communication.—[*Dated July 23rd.*]

1786. Edward Harrison, William Bradbury, and James Buckley, all of Oldham, for a certain improved compound or compounds to be used as a substitute for gunpowder.—[*Dated July 24th.*]

1798. Jeffries Kingsley, of Great Coram-street, for improvements in railways, and in carriages to be used thereon.—[*Dated July 25th.*]

1820. James Bishop, of Gloucester-street, Regent's Park, for improvements in kitchen ranges, and their boilers, and ovens, some of which improvements are also applicable to kettles and other utensils, or apparatus for heating or cooking.

1821. Edward Briggs, of Castleton Mills, near Rochdale, for the application of spun silk waste, made in winding and weaving, to manufacturing purposes, and improvements in machinery employed in operating on such silk waste.

1822. Edward Dugdale, of the Soho Foundry, Blackburn, for certain improvements in looms for weaving.

1823. Joseph Renshaw, of Salford, for improvements in machinery or apparatus for finishing velvets, velveteens, and other pile fabrics.

1824. Richard Archibald Brooman, of Fleet-street, for improvements in belts,—being a communication.

1825. Richard Archibald Brooman, of Fleet-street, for improvements in the manufacture of linseed oil, and in apparatus for the same,—being a communication.

1826. Samuel Terrill, of Redruth, for improvements in open-air cooking apparatus.

1827. Joseph Olorenshaw, of Coventry, for an improvement or improvements in spectacle frames,—being a communication.

1828. Thomas Wilson, of Birmingham, for improvements in breech-loading firearms and ordnance.

1829. John Jeyes, of Cheyne-walk, Chelsea, for improvements in the manufacture of boots and shoes.

1830. Henry Jackson, of Oak-lane, Limehouse, for improvements in fire-bars.

The above bear date July 27th.

1831. John and George Dakin, both of Heywood, Lancashire, for improvements in machinery employed in covering top rollers, used in preparing, spinning, and doubling cotton and other fibrous materials.

1832. Henry Brown and Brook Hodgson, both of Halifax, Yorkshire, for improvements in the manufacture of a certain cloth or fabric, commonly called Utrecht velvet.

1833. George Charles Hunt, of Rotherhithe, for improvements in coloring bricks, tiles, and other similar articles.

1834. Gaston Charles Ange Marquis d'Auxy, of Rue Lafayette, Paris, for an improved apparatus for the preservation of corn.

1835. William Morris, of Lambeth, for improvements in the construction of ships or vessels, and in the mode of propelling them.

1836. Lawson Lansdell, of Ipswich, for improvements in the manufacture of harrows.

1837. John Hamilton, junior, of Liverpool, for improvements in vessels to be propelled by steam power.

1838. George Henry Birkbeck, of Southampton-buildings, for improvements in looms for weaving velvet or other cut-pile fabrics,—being a communication.

1839. John Pickering Hodgson, of Newcastle-upon-Tyne, for an improved coffee-pot.

1840. James Ireland, of Wambrechies, near Lille, France, for improvements in machinery or apparatus for treating hemp, flax, tow, and other fibrous substances.

1841. Jean Henri Pape, of Paris, for improvements in the construction of pianofortes.

1842. Samuel Alfred Carpenter, of Birmingham, for a new or improved adjuster for adjusting the backs of waistcoats and trousers, which said adjuster may also be used as a substitute for the fastenings ordinarily employed in fastening gloves, garters, and belts.

The above bear date July 28th.

1843. Louis Rome, of the Route du Pont de Fer, near Grenoble, for a

machine for the fabrication of fishing or other nets.

1844. Francis William Searle, of Coleman-street, for an improved apparatus for giving information at doors and places of business.

1845. James Rahill, of Ramsgate, for improvements in quadrants, sextants, or other similar instruments to which artificial horizons are applicable.

1846. William Gough, of Birmingham, for an improvement or improvements in balancing millstones.

1847. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improvement in brushes for the hair or other purposes,—being a communication.

1848. Hilton Greaves, of Oldham, for improvements in hecks, or mechanism, or arrangements, used in warping yarns or threads.

1849. Joseph Nicholson, of Whitehaven, for improvements in reaping and mowing machines.

1850. William Spence, of Chancery-lane, for improvements in the manufacture of hats,—being a communication.

1851. Oswald Dodd Hedley, of Newcastle-upon-Tyne, for improvements in obtaining motive power, and in evaporating liquids.

The above bear date July 30th.

1852. Alphonse Vital Donnet, of Lyons, for an improved registering water meter.

1853. John Monteath Douglas, of Cupar Fife, Scotland, for improvements in the delivery of the cut crop from reaping and mowing machines.

1855. Henry William Ford, of Gloucester, for improvements in elastic buffing and drawing apparatus, suitable for railway vehicles.

1856. John Goucher, of Worksop, for an improvement in beaters for thrashing machines.

1857. John Stephen Jarvis, of Wood-street, for an improved scarf or neck-tie.

1858. William Pickstone, of Manchester, for improvements in the manufacture of tubes or pipes.

1859. Frederick Henry Trevithick, of Guildford-road, Clapham, and Richard Jones, of Botolph-lane, for improvements in means or apparatus to be used in effecting the preservation of animal and vegetable substances.

1860. Joseph Wilcock, of Chancery-lane, for improvements in photographic apparatus,—being a communication.

The above bear date July 31st.

1861. Joshua Jackson, of Wolverhampton, for purifying and cooling water and atmospheric air, which he calls 'the carbonic aerial water and air purifier and cooler.'

1862. Edward Orange Wildman Whitehouse, of Brighton, for improvements in testing insulated conductors.

The above bear date August 1st.

1865. Abraham Ripley, of Bridge-street, Blackfriars, for improvements in the mode and process of treating the waste and refuse of leather, and in the mode of treating and operating upon these, in order to form a new article or fabric.

1866. Albert Frederick Haas, of Jewin-street, for improvements in dolls,—being a communication.

1867. Ebenezer Partridge, of Stourbridge, for improvements in axles and axle boxes.

1868. John Grant, of Hyde-park-street, for improvements in breech-loading guns.

1869. William Ford and Thomas Proctor, both of Derby, for improvements in sewing machines.

1870. Auguste Victor Morel, of Paris, for an improved apparatus for printing in colors textile fabrics and other surfaces.

1871. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in knitting machinery,—being a communication.

1872. John Coope Haddan, of Bessborough-gardens, Pimlico, for improvements in the manufacture of rifled cannon, and of projectiles to be discharged from rifled cannon.

The above bear date August 2nd.

1873. John Talbot Pitman, of Gracechurch-street, for an improved process in the vulcanization of india-rubber and other similar substances under pressure,—being a communication.

1874. Benjamin Arnold, of East Green-

wich, Rhode Island, U.S.A., for improvements in machinery for netting.

1875. John Talbot Pitman, of Gracechurch-street, for an improved press,—being a communication.

1876. John Hall, of Blackburn, for improvements in sewing machines.

1877. Edward Billington, of Manchester, for improvements in machinery or apparatus for combing cotton, wool, flax, tow, silk, and other fibrous materials; and in machinery or apparatus for preparing the same to be combed or carded.

1878. Francis Xavier Kukla, of Pentonville-road, for an improved self-regulating gas burner.

1879. James Higgin, of Manchester, for improvements in railways, in railway carriages, and in the mode of retarding and stopping railway carriages.

1880. Samuel Stacy Skipton, Assistant Surgeon 78th Highland Regiment of Foot, for an improved splint for gunshot and other compound fractures of the limbs.

1881. Edouard Armand, Count de Strada, of Paris, for improvements in horses' bridles.

1882. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for a new or improved musical instrument,—being a communication.

1883. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improvement in wooden-soled boots and shoes, or clogs,—being a communication.

1884. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in washing machines,—being a communication.

1885. William Clark, of Chancery-lane, for improvements in embroidering machines,—being a communication.

1886. John Stephens, of Bath, for improvements in the arrangement of wheeled carriages, to facilitate their movement on soft or uneven land.

1887. Jacques Rives, of Paris, for improvements in looms for weaving, and in preparing cards for the same.

1888. Ephraim Upham Thompson, of Bristol, U.S.A., for improvements in machinery or apparatus to be applied to a shroud, stay, or other portion of the rigging of a navigable vessel, in order to enable the setting or tightening thereof to be effected and maintained.

The above bear date August 3rd.

1890. William Taylor, Jeremiah Pendlebury, Thomas Bailey, and Richard Harrell, all of Preston, Lancashire, for improvements in 'temples' used in weaving textile fabrics.

1891. William Edward Gedge, of Wellington-street, Strand, for an improved cork cutting machine,—being a communication.

1892. James Hunter, of Cambusnethan, Lanarkshire, N.B., for improvements in machinery or apparatus for boring and winding for mining purposes.

1893. Johan Fredrick Klintin, of Stockholm, for improvements in ships' logs.

1894. James Lancelot, of Rose-terrace, Buxton-road, Essex, for improvements in machinery or apparatus for the manufacture of small metallic chains, and also in the manufacture of such chains.

1895. James Higgins and Thomas Schofield Whitworth, both of Salford, for improvements in carding engines.

1896. Thomas Webb, of Uttoxeter, for improvements in gates.

The above bear date August 4th.

1897. William Redgrave, of Wood, street, Lambeth, for an improved inflated, undulating, artificial bust.

1898. Adolph Julius Seitz, of Newcastle-upon-Tyne, for an improved manufacture of artificial sulphate of baryta,—being a communication.

1899. Henry de Mornay, of Bayswater, for improvements in apparatus for sorting and preparing tea for the market.

1900. George Jeffries, of Norwich, for improvements in machinery or apparatus for filling cartridges.

1901. Frederick Schwann, of Gresham-street, for improvements in dressing and stiffening fabrics and yarns.

The above bear date August 6th.

1902. Robert Coxon, of Beeston, near Leeds, for improvements in hoops or apparatus for giving shape or distension to female attire.

1903. Frederic Hudson, of Blackfriars-road, for improvements in spring rollers for window blinds.

1904. Joseph Bonne, of Cluis Indre,

France, for improvements in furnaces intended to work iron ore.

1905. Charles Langdon Davies, of Queen-square, Bloomsbury, for improved apparatus for printing and embossing.

1906. William Clark, of Chancery-lane, for improvements in pattens or clogs, and coverings for the feet,—being a communication.

1907. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improved apparatus for retarding carriages,—being a communication.

1908. Richard Archibald Brooman, of Fleet-street, for improvements in mills for grinding corn and other grain,—being a communication.

The above bear date August 7th.

1909. David Mosely, of Ardwick, for improvements in the manufacture of hats, caps, bonnets, and other coverings for the head, and in machinery connected therewith.

1910. Charles Stevens, of Welbeck-street, for an improved plant protector,—being a communication.

1911. Charles Stevens, of Welbeck-street, for an improved mode of binding up brooms, together with the machine used for that purpose,—being a communication.

1912. Edwin Martin Thornton, of Brooke-street, Holborn, for an improved rein holder.

1913. James Webster, of Birmingham, for improvements in the manufacture of prussiate of potash and Prussian blue.

1914. Richard Archibald Brooman, of Fleet-street, for an improved excavating machine for boring tunnels and performing other excavating operations,—being a communication.

1915. Richard Archibald Brooman, of Fleet-street, for improvements in apparatus for burning gas in carriages, ships, and other moving structures,—being a communication.

1916. Jean Baptiste Crétal, of Saint Malô, France, for a new smoking pipe.

1917. Francis Davidson, of Liverpool, for certain improvements in marine steam-engines.

1918. John Sacheverell Gisborne, of Birkenhead, for improvements in apparatus for supporting or carrying electrical conductors for telegraphic communication.

1919. James Fielding, David Whittaker, and Benjamin Croasdale, all of Blackburn, Lancashire, for improvements in looms for weaving.

1920. George Hall, jun., of Montrose, for improvements in the form and construction of reaping machines.

1921. John Barlow, of Saltley, Birmingham, for improvements in railway signals, for communicating with the engine driver, guards, and other parties, while the train is in motion.

1922. Charles Fontayne Flounders, of Liverpool, for an improvement or improvements in duplicating photographic impressions, and also for certain machinery for the same.

1923. Matthew Dodds, of Bedburn Iron Works, Hamsterley, Durham, for improvements in machinery for moulding, forming, or shaping articles of iron and other malleable metals, and for shearing or cutting iron and other metals.

1924. Ellison Smith, of Keighley, Yorkshire, for improvements in machinery for preparing wool, cotton, flax, and other fibrous materials for spinning.

1925. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the mode of, and apparatus for, superheating steam,—being a communication.

1926. George Henry Newton and Abraham Wild, both of Oldham, for improvements in mules for spinning and doubling.

The above bear date August 8th.

1927. Doctor Filippo Grimaldi, of Teramo, Naples, for improvements in the instantaneous generation of steam.

1928. Henry Earle and William Earle, both of Hereford, for an improvement in connecting skins or sheets of parchment, vellum, or paper together; and in attaching seals to deeds and other instruments.

1929. Henry Cockey and Francis Christopher Cockey, both of the Frome Iron Foundry, for improvements in driving chaff and root cutters, and other agricultural machines.

1930. Anton Neumann, of Pancras-lane, for improvements in the treatment of food for cattle, and in machi-

nery or apparatus employed therein, —being a communication.

1931. Anton Neumann, of Pancras-lane, for improvements in the hanging and fastening of doors, lids, and other hinged covers,—being a communication.

1932. Pierre Mauvillin, of Paris, for an improved sewing and embroidering machine.

1933. Alfred Eddington, of Springfield, Chelmsford, for improvements in draining ploughs.

1934. Francis Parker, of Northampton, for improved coverings for the feet, or parts thereof; suitable more especially as foot-warmers for railway and other travellers.

1935. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improvement in ventilating buildings, vessels, and mines,—being a communication.

The above bear date August 9th.

1936. Joseph Underwood, of Birmingham, for an improvement or improvements in dressing cases and writing cases.

1937. Charles Stevens, of Welbeck-street, for improvements in boilers, —being a communication.

1938. John Crawford, of Manchester, for a certain improvement in machinery or apparatus for spinning cotton and other fibrous substances.

1939. John Summerscales, of Keighley, Yorkshire, for improvements applicable to churns, washing and mangling machines, dough kneading machines, and mixing machines.

1940. Frederik Adriaan Enklaar, of Hattem, Holland, for improvements in implements for cultivating the soil.

1941. Thomas William Plum, of Blaenavon Iron Works, Monmouthshire, for improvements in fixing tyres upon wheels and chairs upon sleepers; part of which is applicable to rivetting generally.

1942. Samuel Middleton, of White-friars-street, for improvements in combining and preparing surfaces of paper and other materials, for the purpose of preventing forgery or fraud in the manufacture of bank notes, cheques, bills of exchange, or other valuable documents.

1943. John Giles, of Cannon-street, for improvements in steam-engines and in steam generators.

The above bear date August 10th.

1944. Charles De Bergue, of Dowgate-hill, for improvements in the permanent way of railways.

1945. Richard Smith, of Glasgow, for improvements in the manufacture of coloring matters for dyeing and printing fabrics.

1946. John Wilkins, of Essex-street, Islington, for an improved inkstand.

1947. Richard Phillips, of Wavertree, near Liverpool, for improvements in harvesting machines,—being a communication.

1948. Henry Holland, of Birmingham, for an improvement or improvements in the manufacture of umbrellas and parasols.

1949. Henry Cotterell, of Balsall Heath, Worcestershire, for improvements in the manufacture of umbrellas and parasols.

1950. Thomas Hart, of Northampton, for an improved brick-making machine.

The above bear date August 11th.

1951. Constant Pierre Eleonore Poussier, of Paris, for improvements in the manufacture of alkaline or other bichromates.

1952. Emma Benjamin Orange, of Barentin, Seine Inférieure, France, for an improved method of, and apparatus for, unloosening horses instantly from a carriage, when frightened or running away.

1953. James Stodart, of Walworth, and John Thomas Bennett, of Dalston, for improvements in ships' propellers.

1954. Stephen Norris, of Great Peter-street, Westminster, and Robert Rogers, of King-street, Covent-garden, for improvements in the manufacture of boots, particularly adapted to military purposes.

1955. Henry Hewetson, of Blackheath, for improvements in rockets, and in apparatus for discharging the same.

1956. James Stuart, of Vulcan-place, Poplar, for improvements in treating hydrocarbon oils.

1957. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved mode of treat-

ing waste vulcanized india-rubber,—being a communication.

1958. Thomas Greenwood, of Leeds, for improvements in the construction of projectiles.

1959. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the mode of, and machinery for, manufacturing hose pipe,—being a communication.

1960. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the mode of, and apparatus for, manufacturing packing for pistons and other parts of machinery,—being a communication.

1961. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the manufacture of driving bands, and in the machinery to be employed in such manufacture,—being a communication.

The above bear date August 13th.

1962. George Leslie, of the Mall, Hammersmith, for improvements in preserving casks and apparatus connected therewith.

1963. John Billing, of Abingdon-street, Westminster, for improvements in chimney tops.

1964. James Reed, of Limehouse, for improvements in pianofortes.

1965. Nicholas Wehnert, of King-street, Cheapside, for improvements in the consumption of fuel, in superheating steam, and in the apparatus employed therefor,—being a communication.

1966. James Lark, of Strood, Kent, for improvements in grinding cement and other substances, and in the machinery or apparatus connected therewith.

1967. William Field and Edward Jeffreys, both of Shrewsbury, for improvements in the permanent way of railways.

1968. Edward Wroughton and Thomas Holmes, both of Nottingham, for improvements in machinery for ornamenting or embossing lace or other fabrics.

1969. Robert Dickson McKibbin, of Earl-street, Blackfriars, for an improved waterproof and non-inflammable material applicable to roofing and to other purposes, for which felt, tarpauling, oilcloth, and such like materials are now used.

The above bear date August 14th.

1970. Pierre Faure, of Avignon, France, for a centrifugal hydraulic pump.

1971. Hippolyte Courtot, of Rheims, France, for an improved machine, with a drawer and moveable knife, used to part and break sugar.

1972. William Jenkinson, of Bentley, near Doncaster, and Alfred Solbé, of Leadenhall-street, for improvements in the connections or joints of the posts and frames of bedsteads and iron houses.

1973. Henry Bernoulli Barlow, of Manchester, for improvements in the manufacture or preparation of indigo, being a communication.

1974. Affifi Lely, of Redditch, for new or improved machinery for grooving sewing machine needles.

1975. Gabriel Doidi, of High-street, Borough, for improvements in the preservation of meats.

1976. William Holms and Jabez Oldfield, both of Glasgow, for improvements in machinery or apparatus for weaving.

1977. George Gage, of Luton, Bedfordshire, for improvements in the coloring and manufacture of straw plaits.

1978. Peter Augustin Godefroy, of King's-mead Cottages, New North-road, for improvements in the mode of insulating and laying down inland telegraphic wire.

1979. William Walton, of Houghton Dale, near Manchester, for improvements in the manufacture of wire cards and in machinery used therein.

1980. Charles Green and William Asbury, both of Birmingham, for improvements in machinery for manufacturing tubes for tubular steam boilers.

1981. Alfred Fryer, of Manchester, for improvements in centrifugal machines.

1982. James Samuel, of Great George-street, Westminster, and George Francis Train, of Liverpool, for improvements in rails for streets and roads, and in wheels and axles to be used thereon.

1983. Jean Bluzat, Marcelin Rivière, Claude Bluzat, and Frederic Maigron, all of Marseille, for improved machinery or apparatus for obtaining and applying motive power.

The above bear date August 15*th.*

1984. Joseph Bentley, of Liverpool, and David Bentley, of Birmingham, for improvements in breech-loading fire-arms.

1985. William Petrie, of Woolwich, for improvements in the manufacture of sulphuric acid, and in apparatus employed therein; parts of which improvements are applicable to the obtaining of draught, to the condensing of gases, and to the constructing of flues.

1986. Herrmann Grundt, of St. Louis, U.S.A., for improvements in pontoons.

1987. Thomas Mellodew, of Oldham, and Charles William Kesselmeyer, of Manchester, for improvements in the manufacture of velvets and velveteens.

1988. Joseph James Coleman, of Holly Royd, Halifax, Yorkshire, for improvements in the manufacture of coloring matters for dyeing and printing.

The above bear date August 16*th.*

1989. Charles Fanshawe Atkinson, of Sheffield, for the application of steel or iron, to the manufacture of collars and wristbands to be worn as articles of clothing.

1990. Richard Smith, of Glasgow, for improvements in the preparation and production of coloring matter.

1991. Robert Mole and Frederick Major Mole, both of Birmingham, for an improvement or improvements in the manufacture of matchets and cutlasses.

1992. James Wardle, of Bury, Lancashire, for certain improved arrangements of the flues of steam-boilers.

1993. William Middleton and Daniel Fox, both of Glossop, for improvements in machinery or apparatus for making paper.

1995. George Nimmo, of Glasgow, for improvements in the manufacture of steel.

1996. Robert Read, the younger, of Leicester, for improvements in the manufacture of waterproof fabrics permeable to air.

1997. Alphonse Pirotte, of Liègè, for improvements in the construction of condensers.

1998. John Garnett, of Windermere, for improvements in writing desks, and in apparatus connected therewith.

The above bear date August 17*th.*

1999. Robert Tempest and James Tomlinson, both of Rochdale, for improvements in certain machines for preparing cotton and other fibrous materials.

2000. Daniel Foxwell, of Manchester, for improvements in sewing machines.

2001. William Henry Crispin, of Stratford, for an improved propeller.

2002. George Tidcombe, of Watford Iron Works, for improvements in hydrostatic presses.

2003. Robert Romaine, of Devizes, for improved machinery applicable to steam cultivation.

2004. Frederick Burnett Houghton, of Eldon-road, Kensington, for improvements in the manufacture of paper when the straw of wheat, barley, oats, rye, or rice is employed.

2005. Thomas Grahame, of Leamington, for improvements in projectiles and cannons, or barrels for discharging the same.

The above bear date August 18*th.*

2006. James Boott, of Lille, France, for improvements in the manufacture of various weavings in bobbin net, and in machinery for the same.

2007. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved guard for boots, shoes, and clogs,—being a communication.

2008. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved mode of coupling the rails of railways,—being a communication.

2009. Edward Bridgman, of Tarragona, Spain, for improvements in the construction of wet gas meters.

The above bear date August 20*th.*

2010. Hugh Greaves, of Besborough-gardens, Pimlico, for improvements in the construction of railways, tramways, or tracks for carriages, and in the appliances for the conveyance of passengers, parcels, and letters thereby.

2011. John Neal, of Birmingham, for a new or improved mixture or composition for fumigating plants, and thereby destroying insects infesting the said plants.

2012. William Edward Gedge, of Wellington-street, for improvements in apparatus for obtaining motive power based upon the hydrostatic paradox, —being a communication.

2013. James Campbell, of Adelaide-road, Haverstock-hill, for improvements in apparatus for removing sand or mud from the bottom of the sea, and of rivers, docks, and harbours.

2014. Charles Edmund Wilson and Henry George Hacker, both of Monkwell-street, for improvements in machiney for the manufacture of chenille.

2015. Edward Hall, of Dartford, for improvements in machinery for grinding and smoothing glass.

2016. Moritz Jacoby, of Nottingham, for improvements in the manufacture of twist-lace in twist-lace or bobbin-net machinery.

2017. Angier March Perkins, of Francis-street, Regent-square, for improvements in apparatus for distilling sea and other water.

The above bear date August 21st.

2018. Robert West, of Walsall, for improvements in the construction of wet gas meters.

2020. Joseph Jobin and Auguste Boll, both of Robert-street, Chelsea, for improvements in cigarettes and mouth-pieces, and in apparatus used in manufacturing cigarettes.

2023. William Clark, of Chancery-lane, for improvements in the preparation or manufacture of manure,—being a communication.

The above bear date August 22nd.

2025. James Newhouse, of Farnworth, near Bolton-le-Moors, for improvements in, or applicable to, certain machines for spinning and doubling cotton and other fibrous materials.

2027. Edward Orange Wildman Whitehouse, of Brighton, for improvements in testing insulated conductors.

2029. William Walter Cannon and Robert Jackson, both of Bolton, for certain improvements in machinery or apparatus for spinning cotton and other fibrous substances.

2030. Sir John Scott Lillie, of Pall Mall, for improvements in blocks for building purposes.

2031. Charles Weiss, of Huddersfield, for improvements in the manufacture of cloth, and in preparing and cleaning woollen flock,—being a communication.

2032. William Spence, of Chancery-lane, for improvements in padlocks and keys for the same,—being a communication.

2033. Jean Hector Chambon Lacroisade, of Paris, for an improved apparatus for heating tailors' irons and other irons, also for cooking and other heating purposes, with irons adapted to be used therewith.

The above bear date August 23rd.

2034. Richard Rome Bealey, of Manchester, for improvements in shirt-fronts.

2036. William Keen, of Horton, near Slough, for improvements in castors.

2037. Henry Pritty, of Victoria-grove West, Brompton, for improvements in apparatus used to damp paper for copying letters and other documents.

2038. Antoine Halter and Françoise Decorce Widow Douard, of Paris, for improvements in the manufacture of flexible tubes for the conveyance of water, illuminating gas, or other fluids.

2039. Stephen Greenwood, of Bradford, Yorkshire, for certain improvements in looms for figure weaving.

2040. Frederick Lambe, of Cushion-court, Old Broad-street, for improvements in the construction of certain parts of oil lamps and other lamps, —being a communication.

2041. Andrew Barclay, of Kilmarnock, for improvements in pumping engines.

2043. Ferdinand Pierre Jean Vanden Ouwelant, of Paris, for improvements in apparatus to be applied to fire-places, for obtaining absorption of the smoke and a better combustion of the fuel employed therein.

2044. William Clark, of Chancery-lane, for improvements in apparatus used in reproducing designs in tapestry or wool work,—being a communication.

2045. Julian John Révy, of York-street, Portman-square, for an improved construction of screw propeller.

2046. George Kershaw, of Slough, for

improvements in the construction of medico-electric surfaces.

The above bear date August 24th.

2047. William Thomson, of Glasgow, and Fleeming Jenkin, of Stowting, Kent, for improvements in the means of telegraphic communication.

2048. George Davies, of Serle-street, for certain improvements in the construction of bomb shells,—being a communication.

2050. Jonathan Newall, of Dukinfield, for certain improvements in apparatus for transferring the latent heat of steam to water or other fluids.

2051. John Wilkes, Thomas Wilkes, and Gilbert Wilkes, all of Birmingham, for a new or improved method of manufacturing wire for electric telegraphs, and for such other uses as the same is or may be applicable to.

2052. Edwin Thomas Truman, of Old Burlington-street, for an improved method of cleansing and purifying gutta-percha, and other like substances, and their compounds, and an improved apparatus to be employed therein.

2053. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved mode of treating hides and skins preparatory to the tanning process,—being a communication.

2055. Robert Jobson, of Dudley, and Robert James Ransome, of Ipswich, for improvements in apparatus used in producing moulds for casting.

2056. John Chatterton, of Highbury-terrace, and Willoughby Smith, of Pownall-road, Dalston, for improvements in the manufacture of telegraphic cables.

The above bear date August 25th.

2058. Marc Antoine François Mennons, of Paris, for improvements in salt-cellars, pepper-castors, and similar utensils,—being a communication.

2059. William Clark, of Chancery-lane, for improvements in fire-arms,—being a communication.

2060. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the manufacture of sheet tin, and in the machinery or apparatus employed therein,—being a communication.

2061. John Arrowsmith, of Bilston, Staffordshire, for new or improved sash-iron for conservatories and other structures, made principally of glass, and also for windows and skylights, and other like purposes.

2062. George Tomlinson Bousfield, of Loughborough Park, Brixton, for improvements in thrust bearings for propeller shafts, and for other purposes,—being a communication.

2063. George Tomlinson Bousfield, of Loughborough Park, Brixton, for improvements in building water craft,—being a communication.

2064. George Tomlinson Bousfield, of Loughborough Park, Brixton, for improvements in stuffing boxes, and the packing thereof, for the piston-rods of steam-engines, and for other purposes,—being a communication.

2065. George Tomlinson Bousfield, of Loughborough Park, Brixton, for improvements in surface blow-offs for steam-boilers,—being a communication.

2066. Richard Archibald Brooman, of Fleet-street, for improvements in melodeons and similar keyed musical instruments,—being a communication.

2067. Claudė Louis Piaton, of Lyons, France, for machinery or apparatus for washing yarns and other textile fabrics or materials in skeins.

2069. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in bakers' ovens,—being a communication.

2070. Colin Mather, of Salford, for improvements in gas singeing apparatus.

The above bear date August 27th.

2071. Peter Effertz, of Manchester, for improvements in machinery or apparatus for making bricks, tiles, and similar articles, and in apparatus for transporting the same, which improvements are also applicable for the utilizing of turf, peat, coal dust, or similar substances.

2072. Jacob Henry Radcliffe, of Oldham, for improvements in lubricating cans or vessels.

2073. Henry Marriott, of Preston, for improvements in fire-escapes.

2074. Charles William Siemens, of Great George-street, Westminster, for improvements in engines to be worked by the alternate expansion

and contraction of steam and other elastic fluids.

2076. Edwin Ellis and William Redgate, both of Nottingham, for improvements in apparatus employed in bobbin-net or twist-lace machines.

2077. Benjamin Hirst, of Leeds, for improvements in the construction of steam and other engines.

2078. Michael John Haines, of Bristol, for improvements in the manufacture of driving straps.

2079. Caleb Kilner, George Kilner, William Kilner, and John Kilner, all of Thornhill, near Dewsbury, Yorkshire, for improvements in the manufacture of glass bottles, and the apparatus connected therewith.

The above bear date August 28th.

2080. Henry Chandler, of Clement's-inn-passage, and Amis Hempson, of Southampton-buildings, for improved seats for theatres or other public buildings.

2081. Richard Vines, of Great College-street, Camden-town, for self-acting transverse floats, for the propelling of steam vessels without any backwater.

2082. John Edwards, of Aldermanbury, and Charles Iliffe, of Birmingham, for improvements in the manufacture of buttons.

2084. Joseph Wilson, of Birmingham, for a new or improved warm bath.

2085. William Henry Wain, of Birmingham, and William Instone, of Wolverhampton, for a new or improved lamp.

2087. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the manufacture of iron and steel,—being a communication.

2088. Richard Perrott, jun., and John Molony, both of Cork, for an improved mode of applying roasting jacks to kitchen ranges and cooking stoves.

2089. Sir Peter Fairbairn, of Leeds, for improvements in the construction of rollers used in machinery for preparing hemp and flax.

2090. Richard Archibald Brooman, of Fleet-street, for improvements in apparatus for manufacturing embossed or figured fabrics in colors,—being a communication.

The above bear date August 29th.

2092. Hippolyte Mège, of Paris, for improvements in making bread and ship biscuit.

2093. André Alexandre Beaumont, of Paris, for an engine for raising liquids.

2094. Enoch Lockett and Herbert Goodwin, both of Great Fenton, Stoke-upon-Trent, for improvements in stacking earthenware during the process of firing; and in apparatus used for that purpose.

2095. George Pomeroy Dodge, of St. Paul's Churchyard, for improvements in pumps and in apparatus for working the same,—being a communication.

2097. Josiah Jones, jun., of Liverpool, for improvements in gun carriages.

2098. Charles Jean Baptiste Renault, of Paris, for improvements in the manufacture of shirts and chemises.

2099. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in floating structures,—being a communication.

The above bear date August 30th.

2101. Charles Martin, of Isleworth, for improvements in the form and in the method of, and means for, constructing beams, joists, girders, and rails, and in the permanent way of railways generally.

2103. Alexander Southwood Stocker, of Clifton, Gloucestershire, for improvements in the manufacture of horse shoes.

2104. Patrick Michael Belton, of New York, for the manufacture of a compound to be used as a substitute for animal charcoal in refining sugar and otherwise.

2105. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the treatment of zinc and other ores, and in the apparatus employed therein,—being a communication.

2106. William Gerrens, of Tregony, Cornwall, for improvements in horse rakes.

2107. Silas Covell Salisbury, of Essex-street, and John Farmerley Dickson, of Nottingham, for improvements in sewing machines.

2108. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improvement in compositions for tanning skins and hides of all

descriptions,—being a communication.

2109. William Francis Snowden, of Chichester-place, Gray's-inn-road, for improved machinery for cutting chaff.

2110. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in air engines,—being a communication.

2111. Jacob Geoghegan Willans, of Belfast, for improvements in the manufacture of iron and steel.

The above bear date August 31st.

2113. Martin Regul Pilon, of Brussels, for improvements in the manufacture and construction of fire-arms, and in the means of loading the same and controlling more effectually the action of the fire-lock.

2117. William Johnston and William Ross, both of Glasgow, for improvements in taps or valves.

2119. John Fisher, of Leamington, and Joseph Fisher, of Dudley, for an improvement or improvements in oven grates and kitchen ranges.

The above bear date September 1st.

2121. William Forgie and Thomas Finn, both of Nottingham, for improvements in the construction of apparatus for the preservation of life from drowning, and in the preparation of the material employed for this purpose, and for rendering articles buoyant in water.

2123. William Henry Muntz, of Millbrook, Hants, for an improved apparatus for relieving the strain upon ships' cables.

2125. Charles Mason, of Basford, Nottingham, for improvements in apparatus for dressing lace.

The above bear date September 3rd.

NEW PATENTS SEALED.

1860.

419. J. G. Jennings.
485. P. A. J. Dujardin.
493. R. A. Brooman.
494. John Pegg.
495. John Redfern.
499. Edward Mucklow.
500. Samuel Roberts.
505. J. J. Baranowski.
526. J. Lang and C. Chevalier.
527. T. Silver and J. Hamilton.
529. Joseph Lee.
537. P. H. Desvignes.
538. S. F. Shore.
540. W. Munslow and H. Wallwork.
543. E. I. Asser.
544. Zaccheus Wright.
546. George Weir.
547. J. W. Midgley.
555. J. and W. Rickard.
556. J. M. Bryden and W. C. Bryden.
557. William Williams.
558. George Ranken.
559. Henry Swan.
564. R. H. Collyer.
565. P. C. D. Destas.
566. William Krutzsch.
570. I. Bonnet and J. D. Heid.
571. John Milnes.
572. J. Driver and J. Jessop.
573. D. Chadwick and H. Frost.
576. W. H. Nash.
577. J. M. Blashfield.
578. Henry Bessemer.
580. George Edwards.
584. J. W. Lewis.
585. R. A. Brooman.
587. Joseph Eccles.
588. Xavier Mousty.
591. W. S. Hale.
592. W. E. Gedge.
594. Christian Schiele.
595. Edward Humphrys.
596. Joseph Broel.
598. Cyrus Price.
601. W. N. Wilson and J. Pitt.
602. T. W. Ashby and J. Coulson.
604. William Bridges.
610. W. E. Gedge.
611. W. E. Gedge.
612. W. E. Gedge.
614. John Walsh.
615. Pierre Hugon.
616. William Buxton.
620. James Arnot.
623. C. A. Chappius.
625. J. Imray and J. Copeland.
635. George Shearman.
636. George Spiller.
640. Catherine Sheldon.
641. C. F. Bielefeld.
649. J. S. Ottley.
650. J. H. Young.

651. James Rae.
652. William Ullmer.
653. Timothy Morris.
654. F. A. Pope, E. F. Cook, and R. F. Woodward.
656. M. J. E. Jullienne.
657. William Tuxford and G. W. Hills.
661. John Langman.
663. T. W. Ashby and T. Yorke.
666. W. E. Gedge.
667. S. Smith and P. Hathaway.
668. James Wright.
673. Charles Batiste.
675. Michael Henry.
677. James Sim.
680. J. Horton and J. Kendrick.
687. Michael Henry.
691. M. A. F. Mennons.
695. George White.
696. R. B. Sayer.
697. W. Hudson and C. Catlow.
699. William Weild.
703. Thomas Richardson.
705. John Reynolds, jun.
706. John Reynolds, jun.
710. Peter Brotherhood.
711. William Clark.
715. J. Ellis, W. Winterbottom, and J. Bradock.
717. William Clark.
718. C. F. Bielefeld.
720. P. M. Parsons.
721. J. and F. Williamson.
723. J. Aspell, E. Booth, and J. Hurst.
724. Edward Gardner.
726. Alexander Shand.
728. John Brown.
729. James Newhouse.
730. J. I. Taylor.
732. T. Sykes, B. C. Sykes, and J. W. Crossley.
734. William Spence.
736. W. S. Macdonald.
740. John Stainthorp.
741. William Turner.
742. George Crawshay.
743. G. J. Calvert and C. L. Light.
745. John Grainger.
746. G. B. Rennie.
747. David Millard.
750. J. P. Jennings and F. S. Stott.
752. Charles Prater.
755. Charles C. Ashworth.
756. Joel Watts.
758. W. E. Newton.
759. Benjamin Cooper.
760. W. S. Lewis.
761. S. C. Lister.
762. J. Deane, J. Deane, Jun., and W. Harding.
765. Herbert Haywood.
766. John Dale.
769. M. A. F. Mennons.
772. Isaac Blackburn.
774. J. B. Corry.
776. J. M. Carter.
777. James Ronald.
779. H. Gourlay and E. Kemp.
780. Joseph Mitchell.
783. J. H. Johnson.
785. E. G. Renshaw.
794. David Millard.
802. James Leonard.
806. Charles Stevens.
830. D. K. Clark.
831. John Sheridan.
834. E. J. Hughes.
850. W. A. Gilbee.
864. George Mallinson.
878. Michael Henry.
880. William Clark.
895. L. J. Repelin.
906. Joseph Kershaw.
911. E. and W. Westmoreland.
923. Joseph Hill.
955. W. E. Newton.
960. C. Vaughan, W. J. Vaughan, and R. Vaughan.
1014. G. H. Birkbeck.
1036. A. K. Eaton.
1068. W. E. Newton.
1081. Edwin Southorn.
1100. A. V. Newton.
1129. W. E. Newton.
1236. A. V. Newton.
1255. John Green.
1290. J. Paddon and W. Lowther.
1314. William Tasker, jun.
1362. W. W. H. Smith.
1442. A. V. Newton.
1451. A. V. Newton.
1466. M. Myers, M. Myers, and William Hill.
1492. George Hinton.
1499. Rudolph Bodmer.
1521. Walter Macfarlane.
1548. G. J. Firmin.
1557. William Macnab.
1573. John Whitehouse.
1585. H. F. Cohade.
1616. J. T. P. Newbon and T. Smith.
1618. J. Shipley, J. Taylor, and J. Shuttlewood.
1628. Walter Hood.
1632. Joseph Noone.
1645. J. I. Taylor and G. Butler.
1660. F. C. Warlich.
1698. William Bragge.
1733. Philip Vallance.

*** *For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

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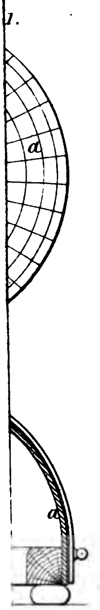

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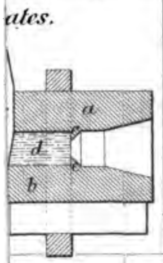
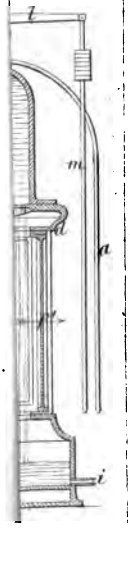
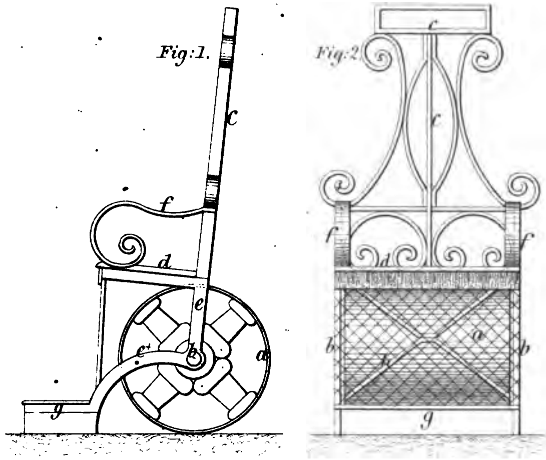


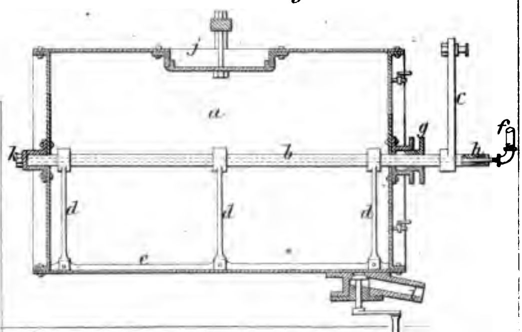
arnishes.



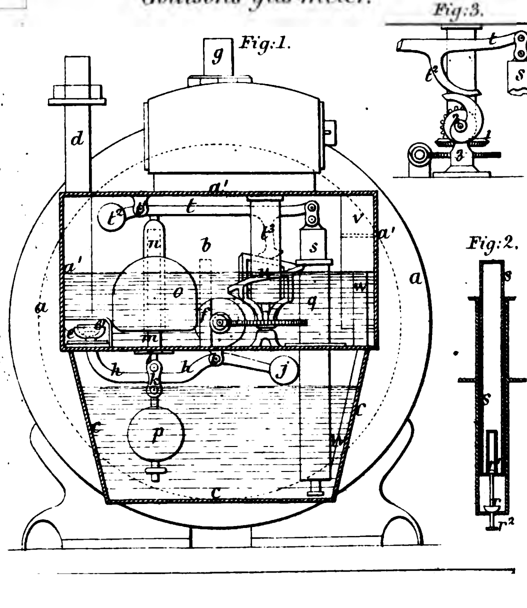
Maude & Tindall's garden roller.

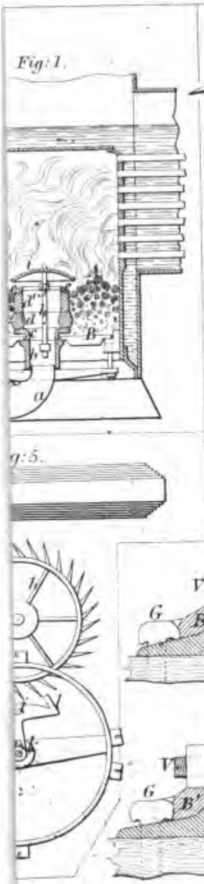


Newton's dissolving ores.

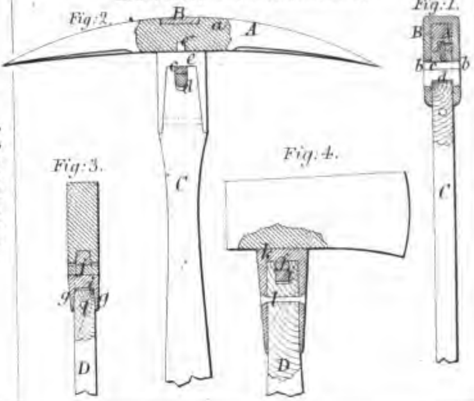


Goulson's gas-meter.

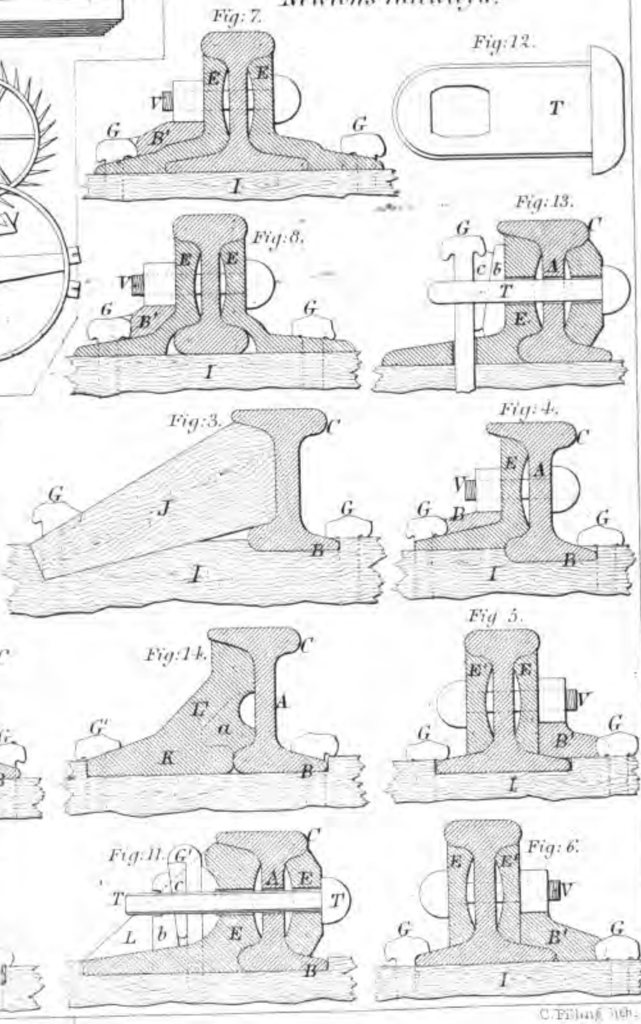




Newton's tool handles.



Newton's railways.



C. Pilling lith.

NEWTON'S
London Journal of Arts and Sciences.

No. LXXI. (NEW SERIES), November 1st, 1860.

A PLEA FOR THE SCIENCE OF POLITICAL ECONOMY.

Under the fantastical title of "Unto this Last," the public has lately been treated, in that already popular and influential journal, the *Cornhill Magazine,* with a series of papers on political economy, from the pen of one who has succeeded in making even that subject endurable to the general reader. We have said that the journal in which this series of papers has appeared, or, to speak more correctly, is appearing, is itself influential; so also is the name of the erratic author, who makes no secret of his identity; and it is for this double reason we desire to put the public on their guard against receiving the groundless accusations which these papers contain against the science of political economy and its professors,—to whom mainly are due the present commercial prosperity and social contentment of Great Britain and her colonies. Our author tells us that the nation, in framing its mercantile relations conformably to the accepted dicta of this science, has systematically disobeyed the first principles of its professed religion; and that the beams of light which are to disperse the haze that has gathered round the *soi-disant* science of political economy, have yet to be shed on the benighted world. Mr. Ruskin does not come to his deductions without good logical reasoning; but in order to reach his conclusions, he has to prepare the ground in a special manner to support his superstructure. Thus, in starting his subject, he says, that the science of political economy, as at present received, is "based on the idea that an advantageous code of social action may be determined irrespectively of the influence of social affection;" and as a proof of this, he adduces the helplessness of the political economist, on the occasion of the late strikes, to convince or calm the opposing parties. Did it ever occur to Mr. Ruskin, that astronomy must be in fault because it could not allay the perturbations of Uranus? Surely it would be a new field for the political economist to undertake to calm the passions of men obstinately set against each other, with the acknowledged purpose of starving each other out. We might as well infer that justice was at fault, because two litigants could not be brought to see the cause in dispute in the same light. But Mr. Ruskin has no sooner shown the inability of the professor of the science of political economy to heal the breach between masters and operatives, than, with a singular in-

consistency, he tells us that it would be strange if he could, "it being not by science of any kind that men were ever intended to be set at one." The next statement which Mr. Ruskin uses as a basis for his argument is, that the science of the political economist "never professed to take advantages of a general nature [obtained by the development of the social affections] into consideration," for his is "simply the science of getting rich." Now, as a man may get rich by fraud or violence, this definition of political economy, we need hardly say, is a base calumny, which the very name of the science suffices to confute; our essayist, therefore, feeling this, to strengthen his position, despatches the word "Political," summarily in a paragraph of ten lines, and slips into its place "Mercantile," which may be applied to individuals; whereas the term "political economy" applies to a state or aggregation of individuals. Having thus prepared his way, he proceeds to show what no rational man could be found to deny, that so far from the art of getting rich being a desirable acquirement, its exercise may prove positively injurious to the country; "rich" being a relative condition opposed to that of "poor," and attained solely through the compulsory, and consequently disadvantageous, services of one man rendered to his fellow. While engaged in exemplifying how men will naturally fall under the dominion, so to speak, of other men, and thus range themselves under the distinctive classes of employers and employed, our author is fair enough; and although he brings out no new phase of the question, his illustrations are judiciously drawn, and serve to show the hopeless folly of those dreamers who would apply the communist principles of equality to the remuneration of labor. But instead of thus applying his examples, he contents himself with the deduction that accumulated masses of wealth may equally evidence the growing poverty as well as the increasing riches of a country; a fact which is so palpable (seeing that wealth may be amassed by extortion or robbery as well as honest trading), that it was hardly worth a remark in a critical essay. There was, however, a design in thus following up a self-evident proposition, for it prepared the way first for a piece of eloquent declamation, commencing with—"Some treasures are heavy with human tears as an ill-stored harvest with untimely rain," and ending with this final deduction,—"And therefore the idea that direction can be given for the gaining of wealth, irrespectively of the consideration of its moral sources, or that any general and technical law of purchase and gain can be set down for national practice, is perhaps the most insolently futile of all that ever beguiled men through their vices."

We might stop here, and enquire, gravely if possible, is it really true that any man having the smallest pretension to the title of

a political economist, has seriously put forth a specific for getting wealthy?—believing that such a thing was only a delusion of the writer's fancy; but we should, by this course, ignore the evidence which the essayist puts forth in his next sentence, to establish his position. And what is that evidence? Let us introduce it in his own words,—"So far as I know, there is not in history record anything so disgraceful to the human intellect as the modern idea that the commercial text, 'Buy in the cheapest market, and sell in the dearest,' represents, or under any circumstances could represent, an available principle of national economy." Here, then, is the great iniquity which these essays are intended to lay bare to the light of day in all its naked hideousness—"*Buy in the cheapest market, and sell in the dearest.*" That is the key-stone of the triumphal arch of iniquity which the modern science of political economy has built up! That is the doctrine the acceptance among us of which there is nothing in history to be found so disgraceful to the human intellect! But what does Mr. Ruskin propose in lieu of this doctrine? for he is not a man to shrink from giving advice. Fortunately, we can afford the answer: it may be gathered in his first paper, entitled "The Roots of Honor," where he defines the nature and duty of each of the five great intellectual professions, viz., the soldier's, the pastor's, the physician's, the lawyer's, and the merchant's. "The fact is," he modestly says, "that people never have had clearly explained to them the true functions of a merchant with respect to other people." His profession, he proceeds, is "to provide,—that is to say, he has to understand to their very root the qualities of the thing he deals in, and the means of obtaining or producing it; and he has to apply all his sagacity and energy to the producing or obtaining it in perfect state, and distributing it, at the cheapest possible price, where it is most needed." Now if this be not a direct injunction to buy in the cheapest, and sell in the dearest market, there is no meaning in words; for where is any product most needed but where it will fetch the best price? and how is sagacity and energy to be applied in obtaining products, and distributing them at the cheapest possible price, if it be not by seeking out the best market (that is the cheapest, considering the quality of the goods) for buying them?

So far from political economy, as understood and acted upon in this country, being, as Mr. Ruskin says, opposed to the first principles of the religion which we profess, it is really nothing else than an exponent of the truths of those principles. If it has done any service to mankind, that service has been rendered by demonstrating that the fundamental law "love thy neighbour as thyself" applies as truly to communities as to individuals. It is a science that owes its origin to the wrongful acts of communities dictated by self-love or covetousness;

its object being to show that an opposite result to that intended to be secured must inevitably flow from a mistrust of, and departure from, the principle laid down in the divine law above enunciated. Thus the science of political economy says to all nations, ye are brethren, let there be therefore free intercourse between you, that each may contribute to the wants of the other by an unrestricted exchange of the products resulting from your respective labors. To smaller communities, as corporations and guilds, this science says, forego your exclusive commercial privileges, for they operate unjustly by restraining free competition; for every man should be free to labor, where and at what occupation he may please; because the "patrimony of the poor man lies in the strength and dexterity of his hands; to hinder him from employing this strength and dexterity in what manner he thinks proper, without injury to his neighbour, is a plain violation of this most sacred property." To manufacturers, political economy says, cease to produce such articles as require the country to be taxed to secure you a proper remuneration for the capital and labor embarked in your manufacture. The merchant it bids, seek no local monopoly from the laws, but rely on the natural demand of distant localities for the disposal of your merchandise, and supply it of such quality and at such prices as will enable you to retain the market. And to the artizan and laborer it says, rely not on an artificial scarcity of workmen to maintain prices, but leave every honest man free to accept or reject any work that may be offered him. These are the lessons which the science of political economy teaches, and it is the acceptance of these teachings which Mr. Ruskin denounces as surpassingly disgraceful to the human intellect.

While yet this science of political economy was unheard of, and manufactures were beginning to play an important part in the prosperity of nations, it was believed to be highly important that the goods consumed by a nation should be the produce of its own labor, and that every advantage which one nation possessed, or supposed itself possessed of, over another, should, at all hazards, be retained. Thus, although the English Government was willing enough, before manufactures had made any great way in this country, to barter its raw materials—wool being the chief article of export—for the produce of the continent, in the reign of Elizabeth, the breed of our sheep being then greatly esteemed, a law was passed prohibiting the export of sheep, lambs, and rams. For the first offence, the exporter was liable to forfeit all his goods, to suffer a year's imprisonment, and then to have his left hand cut off, in a market town, upon a market day, to be then nailed up; and for the second offence, he was to be adjudged a felon, and suffer death accordingly. Somewhat later, the

woollen manufacture having become firmly established in this country, it was judged that if the continent were deprived of English wool in the fleece, it must be purchased in the manufactured state, to the great encouragement of the industry of this country. A law was therefore passed in the reign of Charles II., making the exportation of wool felony; and as the severity of the law rendered it almost nugatory, an Act of William III. instituted ruinous fines as a punishment for the offence, and oppressive restrictions with respect to the sale and transport of wool, for the purpose of preventing the evasion of the law. At that time, also, and even to a very late period, it was generally believed to be essential to the well-being of a commercial country that it should possess a large amount of the precious metals. The exportation, therefore, of this commodity was looked upon as a serious evil. In some countries, as in Spain and Portugal, sanguinary laws were enacted, but without avail, to keep their gold and silver at home; and in others, laws were passed with the special view of enticing gold to their shores, and of removing the necessity to export it. This legislation was founded on the two principles, "that wealth consisted in gold and silver, and that those metals could be brought into a country which had no mines, only by the balance of trade, or by exporting to a greater value than it imported;" "hence," says Adam Smith, "it necessarily became the great object of political economy to diminish, as much as possible, the importation of foreign goods for home consumption, and to increase, as much as possible, the exportation of the produce of domestic industry. Its two great engines for enriching the country, therefore, were restraints upon importation [of goods that could be produced at home], and encouragement to exportation [of home produce]." With respect to the success of this policy our author says, "the attention of Government never was so unnecessarily employed as when directed to watch over the preservation or increase of the quantity of money in any country." The fact is, that money went like any other commodity, to the best market, and remained there only so long as it could be retained with profit. All obstruction to its free circulation proved only detrimental to the country which had raised the barrier to its egress. But so general was the belief in the virtue of protection to national industry, that every important branch of our manufactures was fenced round from foreign competition; and not only was the export of productive machinery made illegal, but even skilled workmen were, up to a very late period, prohibited by Act of Parliament from carrying their knowledge of mechanism out of the country.

As the imperial governments had in view solely the interests of their respective countries, so the guilds or corporations, pursuing the

same policy on a narrower sphere, were guided solely by local interests, and looked upon all strangers as their natural enemies. Thus none but freemen were allowed to keep retail stores or to work at corporate trades within the limits of their city or borough; and still further to keep down "competition," which Mr. Ruskin informs us means "death," as "cooperation" means "life," the number of apprentices which masters might take was limited by law, and the term of their service was made excessive, so as to prevent the possibility of a workman shifting from one branch of industry to another, as necessity might dictate, or his qualifications justify. By this means, labor and all the products of labor were procurable by the privileged community only at an excessive outlay, which could not fail to retard, if it did not depress, commercial enterprise; for only new, and therefore unfettered trades, could flourish under such a system.

While, under the stimulating influence of foreign trade, the manufactures of Europe were rising to importance, manufacturers were not slow to perceive that they had an exclusive right to the home trade, —like the freeman in his borough—and that the importation of foreign goods, which they could as well supply of home production, must tend to throw their workmen out of employ, and diminish their profits, besides forcing gold out of their country to pay for the imports; they therefore called out for protective duties to home industry; and, as a step further, urged the obtaining, by treaty, the exclusive supply of certain foreign markets, as a set-off for admitting the products which were peculiar to their country. In like manner, the merchants perceived how important it was to the safety of their country to encourage the mercantile navy, and to discourage, as far as possible, the increase of the navies of foreign countries. This could not be more effectually done for this country than by prohibiting foreign ships from trading between British ports or to our colonies; and by confining their operations with this country to the importing of goods the produce of the country to which the vessels belonged; and, on payment of double aliens duty, to the carrying of British goods direct from this country. The law was therefore made to encourage British shipping at the expense of all other nations, and the same policy was pursued in other countries. Merchants also sought and obtained corporate powers, to the exclusion of their fellow countrymen, to trade in foreign parts and distant dependencies. And, to complete the round of protection, the fraternities of workmen established regulations defining the periods and rates of labor; and, by a system of rigid surveillance, enforced conformity to their rules.

This was the state of affairs when the truths of political economy burst upon the world. Thus, when Adam Smith wrote to prove that

all the subtleties of the legislator would be exhausted in vain on the protection of industry, and that mercantile enterprise only required to be left to itself to diffuse the blessings of wealth and contentment around, we may well imagine with what pity he must have been looked upon by those who were enjoying the blessings of protection; serious opposition his doctrines could hardly have met, for no one could fear their adoption; even their author was by no means sanguine on this point, for he writes—"To expect, indeed, that the freedom of trade should ever be entirely restored to Great Britain is as absurd as to expect that an Oceana or Utopia should ever be established in it. Not only the prejudices of the public, but, what is much more unconquerable, the private interests of many individuals, irresistably oppose it." Yet in less than one hundred years from the time this passage fell from the pen of the great founder of the modern science of political economy, so degraded, according to Mr. Ruskin, has the human intellect become in this country, that all who have wealth to exchange, whether of physical strength or mental power, of raw produce, or of manufactured goods, are free, as far as the acts of our legislature are concerned, to seek a market where they please; and even countries, our competitors in manufacture and commerce, are accepting the evidence which they can no longer deny, viz., that freedom of commerce is the key to prosperity.

All, or nearly all, that now remains of protection in this country, is that enjoyed by our workmen, under the dictation of the directors of Trades' Unions—those enlightened authorities whom Mr. Ruskin ought to take to his heart; for do not they believe with him that "the true veins of wealth are purple—and not in Rock, but in Flesh;" and is not every act of theirs directed to produce "as many as possible full-breathed, bright-eyed, and happy-hearted human creatures?" Under their sway, the skilled workman is instructed how to act when his rights are being trampled on: at one time to rebel if unskilled labor is appointed to unskilled laborers; at another time to strike work, if a workman not belonging to his fraternity, or not having wasted his time under a needless apprenticeship, is employed; and again, to intimidate those who are content with their condition, and thereby force them into idleness, with the view of carrying some proposition hostile to the employers of labor. These men, and those who sympathise with them, or blindly follow their dictation, have at least escaped the censure of Mr. Ruskin; for having set at nought, so far as they have been able, the principles on which the science of political economy is based, they cannot be said to have systematically disobeyed the first principles of the religion which they professed to follow; although the want and hopeless misery, which their principles have begotten, may well raise a doubt in the unprejudiced mind as to theirs being the true faith.

RECENT PATENTS.

To CHARLES FRANÇOIS JULES FONROBERT, *of Berlin, for improvements in gilding and silvering silk and other fibrous substances,—being a communication.*—[Dated 25th February, 1860.]

IN coating threads with fibres, according to this invention, gold or silver leaf is first ground on a slab with a muller or otherwise, and mixed with gum water or other viscid liquid until it is reduced to a very fine or impalpable powder. This is washed with pure water to remove the gum, as in the ordinary process of preparing gold and silver in fine powder for painting. The silk thread or other fibrous substance is then prepared by soaking or boiling in a solution of chloride of zinc, and it is then washed in water, and again boiled in water in which the aforesaid gold or silver powder is diffused. It is then again washed in water and dried, and will be found to be covered with a coating of gold or silver. Lustre may be given to it by the ordinary processes of polishing.

To EDOUARD ISAAC ASSER, *of Amsterdam, for a process of photographic proofs with printing or autographic ink, for the purpose of either using them as such, or placing them back on lithographic stones, or on metal.*—[Dated 28th February, 1860.]

THE patentee describes his invention as follows:—"I take paper prepared without size, and steep it in a solution of bichromate of potash; I then dry it in the dark, and by a negative on glass or other transparent negative, placed in an ordinary frame, and exposed to the light with the paper, prepared as above described, I bring the object upon the paper. The impression being thus obtained, I dissolve in water the bichromate of potash upon which the light has not struck. After perfectly drying the paper bearing the impression, I wet it on the back, and place it upon a paper not sized, but damped and stretched upon a glass or other flat and hard object, the impression being uppermost; I then pass over it a roller charged with printing ink, until the impression shows well in black. I then steep the impression in water containing a little nitric or other acid, which will dissolve the bichromate of potash still upon the positive, and remove it from the paper. After drying, the positive is ready. The theory is as near as may be that of lithography, that is to say, it is based upon the principle that water will not combine with a fatty or oily matter. The sheet of paper not sized may be coated with starch previous to its immersion in the bichromate of potash, as much to prevent any picking of the paper as to facilitate the transfer, which I will now describe. By passing a roller, charged with autographic ink, over the impression obtained by bichromate of potash, and treated as above described, I obtain a stereotype suitable for transfer by pressure on to a lithographic stone, from which I draw, by the process known as lithography, autographic prints; this transfer may be made in like manner upon any of the matters which may be used on the same principle for every description of autographic printing, as, for example, zinc or copper, either for reproduction after what is usually termed zincography, or by the aid of galvanoplastic, hollow or in relief. In some cases, the inking may be effected with a rubber instead of a roller, as above described.

To Thomas Smith, *of Cambridge Heath, for improvements in the manufacture of chenille, and in apparatus employed therein.*—[Dated 31st January, 1860.]

This invention relates to the mode of manufacturing chenille and piled fabrics of like kind, and to apparatus for effecting the same.

In Plate X., fig. 1, is a longitudinal section; fig. 2, an elevation of one of the end frames of the apparatus; and figs. 3, and 4, represent portions thereof on a larger scale.

The main framing consists of two longitudinal sleepers or rails *a, a,* fixed at each end to upright frames *b,* and *c.* A toothed rack *d,* is fixed between the rails *a, a.* A carriage *e,* is fitted with flanged wheels to run on the rails, and a hollow mandril *f,* is mounted in bearings in the carriage, with its axis parallel to the rails. A shaft *g,* extending the whole length of the framing, is mounted in bearings in the end frames *b,* and *c,* and has a pulley *s,* fixed on it, which is connected by a strap with three smaller pulleys *t,* mounted on the end frame *c.* The shaft *g,* passes through the hollow mandril *f,* the same being made in such a manner that the mandril can slide freely along the shaft, and at the same time turn round with it. A wheel *h,* is fixed on the mandril *f,* and this wheel has a screw groove cut in its circumference fitting the teeth of the rack *d*; also a pulley *k,* is fixed on the mandril *f,* connected by a strap with a smaller pulley fixed on a hollow mandril *l,* mounted in bearings on the upper part of the carriage *e.* On rotary motion being given to the shaft *g,* the pulley *s,* and the three smaller pulleys *t,* connected therewith, are caused to revolve; at the same time the mandril *f,* is caused to revolve, and this, by means of the pulley *k,* and strap, puts in motion the mandril *l,* while the screw-wheel *h,* revolving in gear with the rack *d,* causes the carriage to move along the rails in the direction of the arrow. In order to move the carriage in the opposite direction, a piece of the circumference of the screw-wheel *h* (which is made to be removable at pleasure), is removed, and thus, by clearing the teeth of the rack, the carriage can be run back by hand.

The hollow mandril *l,* which is mounted in bearings on the carriage *e,* with its bearings and framing, is shown at fig. 3, which is a longitudinal section, and in fig. 4, which is an end elevation. The framing consists of the bearings of the hollow mandril *l,* and of a back and a front upright end plate respectively marked l^1, and l^2. Three pins or spindles for gut reels *p,* and p^1, are fixed on each of these plates; the reels being held on their spindles by springs adjustable by screw-nuts to give the required amount of friction to prevent the reels from turning too freely. A disc-plate is fixed on one end of the mandril *l,* and on this disc are mounted in a similar way several silk reels *m*; there are also fixed on the disc a corresponding number of eyes m^1, for the silk ends to pass through. A tube *n,* secured by adjusting nuts to the back plate l^1, passes clear through the mandril *l,* and at its mouth n^1, fits a triangular base wire *o,* which is stretched from end to end of the main framing, being strained tight by screws and nuts at the end frames *b,* and *c.* This wire *o,* has six grooves along its whole length, viz., a groove at each of its angles and a groove in the middle of each of its sides. Three curved spring brackets *q,* which are fixed to the front plates l^2, bear against the sides of the base wire *o*; these brackets are split up the middle, so that each half may pre-

serve a bearing on the wire in case of inequalities on its surface, and at their front ends they have eyes with pins q^1, loosely fitted therein. Three knives *r*, are mounted on hinged frames secured to the front plate l^2, and these frames have cranked ends acted on by springs, so as to press the cutting edges of the knives *r*, into the angle grooves of the base wire.

In order to put the apparatus in action, the carriage *e*, is drawn up to the end *c*, of the framing, and its screw-wheel geared into the rack *d*; the three guts from the reel *p*, are passed inside the tube *n*, and through eyes n^1, at the end thereof immediately over the grooves in the sides of the base wire *o*, and the three guts from the reels p^1, are passed under the pins q^1, also immediately over the grooves on the sides of the wire *o*, and both sets of guts are hooked to the three twisting pulleys *t*, a pair to each: also, the silk ends from the reels *m*, are passed through the eyes m^1, and twisted several times round the base wire *o*, so as to enclose the guts from the reel *p*, in the side grooves thereof. Rotary motion is then imparted to the shaft *g*, and thence to the twisting pulleys *t*, and the mandril and disc *l*; while at the same time the carriage advances in the direction of the arrow, the wire *o*, being stationary. Silk is thus wound helically thereon, enclosing the gut from the reel *p*, and the silk so wound is cut by the knives *r*, into three equal parts at the time that it is held on the wire *o*, by the spring brackets *q*, and each portion so cut is secured between the two guts from the reels *p*, and p^1, respectively, which are twisted together by the action of the pulleys *t*, so as to dispose the silk as a pile around them.

The patentee claims, "the particular arrangement of machinery for giving simultaneous motion to the carriage, spinning mandril, and twisting pulleys, and the use of a triangular, square, or polygonal grooved base wire, with its guide-tube and brackets and knives, arranged as above described."

To JOHN RICKARD *and* WILLIAM RICKARD, *both of Derby, for improvements in the manufacture of chenille and other piled fabrics, and also in the machinery connected therewith.*—[Dated 29th February, 1860.]

THIS invention of improvements in the manufacture of chenille relates to a novel arrangement of machine which is shown in side view at fig. 1, Plate X., and in plan view at fig. 2. *a, a*, are the end frames of the machine for supporting the rails or tramway *b, b*, and the main driving-shaft *c, c*, which latter receives its motion from a band passing around the main driving-pulley *d, d*, and communicates movement to the other parts of the machine; *e, e*, is an endless cord or band, driven by the pulley *f*, on the shaft *c*, which imparts motion to the carriage *g, g*, by means of the pulley *h*, and also to the twisting hooks *i, i*, by means of the pulley *k*; the pulley being mounted on a cylinder *l, l*, round which the bands *m, m*, driving the twisting hooks *i, i*, pass. The shaft *n, n*, at the lower part of the carriage, being driven by the pulley *h*, actuates a shaft *o, o*, above (see fig. 2,) by means of the speed-pulley *p*, and band *q, q*, passing over the same. Upon this shaft *o, o*, is a worm *r*, driving a worm-wheel *s, s*, fixed on the axle of the propelling-wheels *t, t*, whereby the carriage *g, g*, is caused to traverse slowly along the rails *b, b*. *u, u*, are hollow spindles, which carry bobbins of silk *u**, *u** (see fig. 3), and are furnished with

guiding-wires or flyers *, *. The bobbins and flyers are caused to revolve by means of bands *v*, *v*, passing around their wharves, and also round grooved pulleys on the shaft *n*, *n*. *w*, *w*, are two permanent wires fastened to the crabs *x*, *x*, passed through the hollow spindles *u*, *u*, which carry the bobbins of silk, and round the studs *y*, *y*. These wires *w*, *w*, can be tightened as much as required by means of the crabs *x*, *x*. Upon the shaft *n*, *n*, is a pulley *z*, *z*, which, by means of a band, drives a pulley 1, 1, fixed on the shaft 2, 2, which carries the circular knives 3, 3. 4, 4, are bobbins for holding the centre threads 5, 5, of cotton, fine wire, or other material, which pass over the guiding-rollers 6, 6, at the front of the carriage *g*, *g*.

Fig. 4, is an enlarged view of the cutting apparatus; 7, is an iron stud, supported by the bracket 8, for keeping asunder at this point the permanent wires *w*, *w*, between which the circular knife 3, revolves; 9, represents the chenille, when made, passing over a roller 10, supported by a bracket 11.

In making chenille by this improved process, the carriage *g*, *g*, is first placed at the twisting end of the machine, and having passed one of the centre threads or wires 5, 5, through each of the spindles *u*, *u*, below and between the two permanent wires *w*, *w*, and passed another such thread or wire over and under rollers ×, × (as shown in fig. 1), these threads or wires 5, 5, are together fastened upon their respective twisting hooks *i*, *i*. Motion being then imparted to the machine, the carriage *g*, *g*, is slowly propelled along the rails *b*, *b*, at the same time that—by the revolution of the bobbins *u**, *u**, and flyers *, *, or by discs carrying bobbins—the silk is plaited around the permanent wires *w*, *w*, and one of the fine wires or threads 5, 5, as above described. This silk plaiting is severed upon its upper surface only by the circular knives 3 (as shown at fig. 5), and is, at the same time, caught below in the centre between the two fine wires or threads 5, 5, and by means of the hooks *i*, *i*, twisted up into chenille. The quality of the chenille will depend upon the rapidity with which the carriage *g*, *g*, is made to traverse, and this is regulated by means of the speed-pulley *p* (fig. 2); and the size or diameter of the chenille is determined by the use of thicker or thinner permanent wires *w*, *w*.

In manufacturing other piled fabrics by means of this apparatus, a thick silk piping or twisted cord is substituted for the outer fine thread or wire 5, which being passed over and under the rollers ×, ×, in a similar manner, catches the silk when cut, and is twisted up as one of the centre threads, in the manner before described. By this means the silk pile forms a distinct worm or spiral round the centre threads, thus making a spiral chenille piping or chenille cord.

The patentees claim, "the novel method of, and apparatus for, manufacturing chenille and other piled fabrics, as described, or any mere modification thereof, by which the same end may be attained; and especially the use or employment for such purposes of two permanent fixed wires, round which the silk is plaited by a traversing carriage, and cut by a circular knife revolving between them and travelling with the carriage."

To Abraham Denny *and* Edward Maynard Denny, *both of Waterford, Ireland, for an improved method of, and apparatus for, singeing pigs.*— [Dated 2nd February, 1860.]

This invention relates to a mode of singeing the hairs, bristles, and other matters off the bodies of slaughtered pigs—a process necessary to be performed in the preparation of those carcases which are to be converted into bacon. This process, which has hitherto been accomplished, at a great expense, by burning straw or other material, it is now proposed to effect in a cheaper and more expeditious manner, by the action of flame or heat in a stove or heated chamber.

In Plate IX., fig. 1, shows a transverse section, and fig. 2, a longitudinal section, of a stove or heated chamber, arranged suitably for carrying out this invention. *a*, is an oblong chamber made of brickwork, in which the carcases of pigs are to be singed; *b*, *b*, are fires for heating the chamber, arranged parallel to each other. The current of hot air from the fires passes through the chamber *a*, and the flue *f*. The two flues *e*, and *f*, communicate with the chimney shaft *s*, and dampers are placed at *e**, and *f**, to open, close, and regulate the communication of the flues with the shaft. On lighting the fires, the damper *e**, in the upper flue *e*, is opened for the purpose of heating the stove or chamber, and in working the chamber or stove, the damper of the lower flue *f*, is opened, and the upper one *e*, is closed, or either may be partially closed, according as it may be found desirable for the purpose of producing the requisite effect upon the surface of a carcass in the stove or chamber. Air flues *p*, *p*, are formed under the fires, which may or may not communicate with each other, for the purpose of obtaining the requisite quantity of air to promote combustion; these flues can be closed or opened by means of doors attached thereto. On the division separating the fires is placed a fire-guard *c*, which protects the back of the carcass from the direct action of the fire. The sides of the chambers over the fires are so formed as to direct the flame inwards on to a carcass in the stove or heated chamber. The rails or guides *g*, *g*, upon which the truck *h*, moves, are fixed on fire-bricks *q*, *q*, at the top of the chamber. The carcass of a pig to be singed is suspended by suitable apparatus to the truck *h*. *i*, *i*, are the doors of the chamber *a*: a small space is left between the upper part of these doors for the purpose of passing through a fork to withdraw the truck to which the carcass is suspended when it is seen to be sufficiently singed; the space or opening also serves as a sight hole. The bricks *q*, *q*, upon which the rails are laid, are separated by a narrow opening, to permit the passage of the pendent rods of the truck from which the carcass of the pig is suspended. Access is obtained for the truck to the chamber *w*, by means of a door or flap *k*. A balance-weight is attached to the door by means of a chain passing over guide-pulleys, and is for the purpose of facilitating the opening or shutting of the same; the flap may remain up during the working of the stove or heated chamber.

The mode of operation is as follows:—The damper in the flue *e*, is first opened, and fires lighted in the fireplaces *b*, *b*: when the stove or chamber is made sufficiently hot, the damper in the flue *e*, is closed, and the flue *f*, opened; or each may be partially opened, as may be found desirable. The carcass of a pig is then suspended to a truck *h*, outside

the chamber, in the position shown; the flap-door over the top of the doors *i*, is raised, and the doors *i*, *i*, are opened; the loaded truck is then pushed in, and the doors are closed. The heat will then quickly singe off the whole of the hairs, bristles, and other matters. The operator, by looking through the opening between the doors *i*, *i*, can see when a carcass has been in the stove sufficiently long, and by means of a fork passed through the opening, and dropped into an eye in the back of the truck, can withdraw the carcass of the pig.

The patentees claim, "the method of, and apparatus for, singeing off the bristles, hairs, and other superfluous matters upon the surfaces of the carcasses of pigs by the action of flame or heat in a stove or heated chamber, as hereinbefore described."

To ANDREW KERR, *of Newton Heath, near Manchester, for improvements in jacquard machines.*—[Dated 4th February, 1860.]

THIS invention consists in various modes of giving the jacquard cylinder of looms a yielding movement inwards, in connection with a self-acting arrangement for supporting the cylinder or cylinder batten until the knives of the griff have left the hooks; by which means there is a great economy in the wear and tear of the needles, hooks, and cards, inasmuch as the cards do not press upon the needles when the hooks are upon the knives, but only when they are free from them.

In Plate IX., fig. 1, *a*, is the jacquard cylinder, *b*, the cylinder batten, and *c*, the griff. The outward motion is given to the cylinder by the double lever *d*, one arm of which is connected by the link *e*, to the griff *c*, and the other arm of the link *f*, to the batten *b*. The inward motion is given to the cylinder by the return movement of the same double lever and links until the griff arrives at the hooks, when the cylinder is held off the needles by causing the cylinder batten to be held by the lever or holder *g*, until the griff passes the hooks, which pause is obtained by means of the slot *h*, in the link *f*. As soon as the griff leaves the hooks, the holder *g*, is lowered from the batten by the presser *i*, as shown by the dotted lines, and the cylinder is pressed up to the needle board by the spring *k*, one end of which is on the batten, and the other end on one arm of the double lever *d*, the holder *g*, being maintained in its holding position by means of the spring *l*. In figs. 2, 3, and 4, the jacquard cylinder *m*, is not connected to the batten, but moves to and fro in the slot *n*, and an outward motion is given to it by connecting to the griff *o*, the link *p*, attached to one of the arms of the double lever *q*, to the other arm of which is connected one end of the link *r*, having its other end connected to a slide which works in the slot *n*, and in which the cylinder is centered. The inward motion is given to the cylinder by the return movements of the link *p*, double lever *q*, and link *r*, until the griff arrives at the hooks, when the cylinder is held off the needles by causing the slide in which the cylinder is centered to be held by the holder *s*, until the griff passes the needles; the pause being obtained by the slot *t*, in the link *r*. As soon as the griff leaves the hooks, the holder *s*, is lowered by a pin on the lever *q*, coming in contact with a projection q^1, on the holder, so as to cause it to be free of the slide, and allow the cylinder to be pressed up to the needle-board by the spring *u*, one end of which is on one arm of

the double lever, and the other end connected to the slide in which the cylinder is centered; the holder being returned to its holding position by the spring *v*. In fig. 5, the jacquard cylinder is shown at *w*, centered in the batten *x*, attached to which is the ordinary S iron *y*, in the interior of which works the bowl *z*, connected to the crank iron a^1, which passes through the block of the griff, and has on its extremity a spring b^1. On the cross-bar of the batten near the centre is jointed a link c^1, carrying the bowl d^1, which joint is so formed that the bowl is capable of rising, but cannot descend below a certain point; and connected to the griff is the holder e^1. The S iron *y*, causes the cylinder to move outwards when the griff rises in the usual manner, and also when the griff descends, it causes the cylinder to move inwards until the griff arrives at the hooks, at which time the holder e^1, is in contact with the bowl d^1, and holds the cylinder off the needles until the griff leaves the hooks, the pause of the cylinder being obtained by the yielding of the spring b^1; after which the griff still further descends, and the bowl d^1, rises above the holder and allows the cylinder to be pressed up to the needle-board by the spring b^1.

The patentee claims, "the improved modes of giving the jacquard cylinder a yielding inward motion in connection with a self-acting holder or equivalent arrangement for supporting the cylinder or cylinder batten until the knives of the griff have left the hooks, as described."

To James Carver, *of Nottingham, for improvements in the manufacture of combs used in pusher machines for the making of lace or other articles, and in the manufacture of counters used when casting the same.*—[Dated 8th February, 1860.]

The ordinary comb, heretofore used in pusher machines for making lace or other articles, is liable to break the threads by reason of the divisions and rivets of which it is composed. Now this invention consists in manufacturing the comb solid, instead of in several parts or divisions, thereby rendering it stronger and firmer, and placing the iron or comb more strongly in the metal.

In Plate X., fig. 1, is a side view of one of the improved comb blades and counters in their proper position when placed in a mould to have the metal cast on them; fig. 2, is a side view of the counter; and fig. 3, a side view of the comb: figs. 4, and 5, are end views of the counter and comb. *a*, is the thick part of the counter; *b*, the thin part of the counter; *c*, is the blade of the comb; and *d*, the bearer, which is thicker than the blade *c*, as shown at fig. 5.

Heretofore comb blades have been made of three pieces of thin metal rivetted together, the two outer pieces forming the bearer. The improved blades are made out of one solid piece of iron, each side being ground away to form the blade,—the parts not ground away forming the bearer. A comb is placed in the mould, then by the side of it is placed a counter (fig. 2), a blade and counter being placed alternately; the thin portion of the counter lying between the thick part or bearers *d*, of the blade. When the mould is filled with blades and counters, a wire is passed through the hole *e*, of the blades and counters; the mould is then closed, and metal being poured into it, will surround the portion *d*, of each blade, and part of the blade *c*, lying between the points of the arrows, thereby

firmly holding each blade true and of the gauge required by the interposition of the counters: to take out the counters, the wires are withdrawn.

The patentee claims, "the manufacturing of combs and counters in the manner described."

To GAETANO BONELLI, *of Milan, for improvements in machinery for weaving figured fabrics.*—[Dated 15th February, 1860.]

THIS invention relates to a novel construction and arrangement of mechanism whereby the use of jacquard cards, and of all the apparatus or operations required for the reading and preparing of these cards from an original pattern or design, are dispensed with. For this purpose, instead of these cards, a single plate, of the same dimensions as one of these cards, is employed. This plate has perforations made in it corresponding in number to the horizontal needles of the jacquard apparatus. The perforations are stopped or closed when required, by means of small iron rods, which are drawn forward at suitable times, by means of electro-magnets, but when these small rods are not drawn by the electro-magnets, the openings or perforations in the plate will be left open. The insulated wires of the coils of the electro-magnets are connected respectively to one of a series of thin metallic plates, which come in contact with the pattern, the said pattern being for that purpose painted or drawn upon a flexible metallic sheet, with an insulating varnish; or the design may be composed of a sheet metal pattern, fixed upon an insulating layer, or surface. In order to prevent induction, the insulated wire of the coils of neighbouring electro-magnets is wound in opposite directions, and the magnets are arranged in such a manner that the positive pole of one magnet shall be next to the negative pole of its neighbour.

In Plate X., fig. 1, is a diagram, representing, in side elevation, the principal working parts of the apparatus, connected together in working order. A, is the perforated plate, which performs the office of the jacquard cards; the small horizontal rods *b*, are armatures of the electro-magnets C, and are mounted in the traversing frame *f*, *f*. The rods *b*, are severally provided with a small head or button *d*, and are arranged exactly in front of or opposite to the horizontal needles *e*, of the jacquard apparatus. These rods *b*, with their heads, are capable of passing freely through the perforations in the plate A, (see figs. 2 and 2ª, which are partial sectional views of this part of the apparatus). On the plate A, being slightly lowered, which movement takes place at certain periods (as shown at fig. 2ª), the heads of the small rods or armatures *b*, or a portion of them, will be prevented from passing through the perforations in the plate, and those which are outside the plate will, by covering the adjacent openings, cause the plate, at such covered parts, to act in the same manner as a plain card. The armatures *b*, are supported horizontally in the framing *f*, *f*, which allows of their moving in the direction of their axes. At each shoot of the weft, the frame *f*, moves backwards and forwards, carrying with it the plate A, and presents the extremities of the rods or armatures *b*, to the adjacent poles of their respective electro-magnets C, fig. 1; at the same time small springs, suitably arranged for the purpose, ensure contact between the armatures and the electro-magnets. On the frame *f*, *f*, moving back with the plate A, towards the needles *e*, of the jacquard,

those electro-magnets, which are magnetized by the electric or magnetic current, will attract and hold their armatures or rods *b*, the heads of which will then be caused to pass inside the plate A (see figs. 2 and 2*); the electro-magnets, which are not magnetized, allowing their armatures to remain outside the plate. At this moment, the plate A, will be slightly depressed (as shown at fig. 2*), in order to prevent the heads of the armatures *b*, which have remained outside, from passing through the perforations, against the edges of which they will then be caused to bear and act upon the horizontal needles *e*, of the jacquard apparatus. On the contrary, the heads of the armatures, or rods *b*, which have passed inside the plate A, will leave the corresponding perforations in the plate free or open, and the jacquard needles opposite these perforations will enter therein, and will not be acted upon.

The electro-magnets are brought into the circuit in the following manner:—One of the ends of the wire coils of each of the electro-magnets C, (see the plan view, fig. 3,) communicates with a common wire *e*, which ends at one of the poles of the battery *c**, or magnetic apparatus. The other end of the wire of the coil of each electro-magnet, is attached to a metallic plate *m*; there is the same number of metallic plates *m*, as there are magnets and armatures *b*, and all these plates *m*, are brought to a point at their lower extremity. The plates *m*, are arranged in a line, and parallel to each other, between the teeth of an insulating comb *n*, *n*. At a certain period of the operation, the lower pointed extremities of these plates *m*, bear or rest upon the pattern-sheet P, which is mounted upon a rotating cylinder Q, below, and according to whether the plate *m*, (taking the operation of one plate as an example of the whole series) touches the pattern upon a metallic or insulated portion of its surface, the electro-magnet C, corresponding to that particular plate, will be magnetized or not, and consequently the corresponding armature *b*, will act or not upon the horizontal jacquard needle *e*, lying opposite thereto. The second pole of the battery, or magnetic apparatus, communicates with the metallic pattern sheet, by means of the metallic plates *m**, (fig. 3) which bear upon the metallic edges or bands of the pattern.

The circuit breaker B, forms an important part of the apparatus. Its office is to break the electric circuit temporarily, and at a particular moment, every time it is necessary to bring the plates *m*, into contact with the metallic surface of the pattern P, or to remove them from such contact. The object of this temporary rupture of the electric circuit is to prevent the evolution of an electric spark between the plates *m*, and the pattern P, whereby the latter would be liable to injury. This circuit breaker B, is brought into action by the motion of the traversing frame *f*, *f*, and serves to make and break the circuit at the proper time. It will be seen that the circuit breaker consists of two spring plates B, and B*, one placed above the other, but a short distance apart. The electric current must pass through the plates B, and B*, to complete the circuit; but this cannot take place until the two plates are brought together. To effect this latter object, the plate B, is provided with an inclined plane, against which a smaller roller *o*, carried by the traversing frame *f*, is brought, when the frame *f*, moves towards the magnets; and thus the spring plate B, being forced into contact with the under plate B*, the circuit is completed. The operations and motions of the several parts are, however, so timed that the plates *m*, are brought into contact with

the metallic pattern P, before the circuit is completed with the apparatus B, B*. The armatures or rods *b*, having been selected according as the plates *m*, may or may not be in contact with an exposed metallic part of the pattern, the frame *f*, and plate A, are carried forward, and caused to operate upon those horizontal needles of the jacquard, which are opposite the protruding ends of the armatures; and by thrusting aside out of the reach of the griff, certain of the hooked wires *q*, the proper threads only of the warp will be drawn up by the harness *q**, when the griff *r*, rises in the usual manner. The movement forward of the frame *f*, which is by preference effected by the rise of the griff, as shown at fig. 1, will carry away the roller *o*, from the inclined plane of the spring plate B, and thus break contact, and break the electric circuit. The plates *m*, may then be lifted off from the metallic pattern without the risk of producing an electric spark. On the return of the frame *f*, the plate A, will rise to free the armatures (it being caused to traverse over an inclined plane), and the readjustment of the armatures preparatory to forming the next shed, will be effected by the electro-magnets.

When it is desired to weave in various colors, those parts of the pattern which are intended to be made of different colors must be insulated, so that the warp threads of one color only may be operated upon at the same time. This object is effected by superposing successively, one above the other, metallic patterns, representing each a particular color. Each of these metallic patterns is insulated from the contiguous ones, by means of a layer of some insulating substance, such as varnish, and communicates with a metallic band, placed at the side of the metallic pattern sheet or band, and running throughout its whole length; every color of the pattern then has a lateral metallic band, which represents it. One of the poles of the battery communicates successively with each of the lateral metallic bands, and, as they are all insulated, the circuit will not be complete, except in those parts of the pattern representing the color corresponding to the lateral metallic band with which the pole of the battery is in contact. This done, only the proper warp threads, corresponding to a particular color, will be lifted by the griff, for the passage of the shuttle. When one color has been selected, the pole of the battery is changed to the metallic band corresponding to and communicating with those parts of the pattern which represent another color, and so on in succession, until all the colors of the pattern have been selected. In some cases, for the reduction of the pattern, sheets, crossed with lines, by means of a machine, are employed, which draws the lines in both directions of varying widths at will; or the pattern may be composed of moveable types, set up in the same way as printing types. The metallization of the pattern may be effected by the galvano-plastic or electro-deposition process.

In concluding his specification, the patentee says, "I claim, First,—the mechanical contrivance, herein set forth, for selecting and holding back, and retaining in a working position, the armatures, for the purpose above explained. And note, it is important that the apparatus herein set forth, or some equivalent contrivance, should be used for making and breaking the electric circuit, so that no electric spark may be evolved when the plates *m*, are brought into contact with, or withdrawn from, the metallic pattern P. I also deem important the mode, hereinbefore described, of forming the coils of the electro-magnets, and of arranging

the latter, so as to prevent induction. Secondly,—I claim the means, herein set forth, for producing patterns in divers colors."

To THOMAS LOVELIDGE, *of Philadelphia, U.S.A., for improvements in looms for weaving.*—[Dated 22nd February, 1860.]

THIS invention relates to a peculiar construction and arrangement of self-acting apparatus for letting off the warp, and maintaining it at a uniform tension during the process of weaving; which mechanism is equally applicable to ordinary hand or power looms (whether for weaving plain or figured goods) and to knitting and lace-making frames where delicate warp threads are used.

In Plate IX., fig. 1, is a side view of so much of an ordinary power loom as is sufficient to illustrate the improvements; and figs. 2, and 3, are diagrams illustrating the operation of the improvements. *a, a,* are the two side frames of an ordinary power loom; *b,* the cloth beam, situated in front of the loom, and turning in bearings in the opposite frames; *c,* is the breast beam; *d,* the "slay," or "lathe," secured to the slay swords or arms *e, e,* which work on centres in the two frames; *f,* is a spindle for supporting the harness or heddles; and *g,* is the warp beam, hung to the rear end of the loom, and turning on centres carried in bearings in the opposite frames *a, a.* The necessary vibrating motion is imparted to the slay by the cranked driving-shaft, and connecting-rods common to power looms generally. To one end of the warp beam *g,* is secured an escapement-wheel *h,* to the teeth of which are adapted the two pointed projections *a**, *a**, of the "pallet lever" *i,* which vibrates on a pin on one of the side frames of the loom, and has a weighted projection or lever, tending to maintain the lower projection *a**, in gear, and the upper projection *a**, out of gear with the teeth of the pallet wheel. On the upper end of the pallet lever *i,* and forming part of the same, is a projecting arm *i**, to which is hung the horizontal lever *j,* which will be more particularly alluded to hereafter. *k, k,* are two levers, secured one near each end of a shaft *h**, which is hung loosely to the opposite frames of the loom. Each lever is furnished with a sliding weight *l,* which may be adjusted to any desired position, and the bent ends of the opposite levers are connected together by a pressing bar *m**, which is situated between the two rollers *n,* and n^1, the latter turning in brackets *m,* one of which is secured to each frame of the loom. The position occupied by the pressing bar *m**, in relation to the rollers *n* and n^1, will be best seen on referring to the diagrams, figs. 2 and 3. One of the weighted arms *k,* or the end of the bar *m**, near one of these arms, bears on the end of one arm of the horizontal lever *j,* the opposite arm projecting forwards towards the rear of the lathe *d,* to which is secured an arm or finger *f**.

The warp, which is shown in dotted lines, passes from the beam *g,* upwards over the roller n^1, under the pressing bar *m**, of the levers *k, k,* over the roller *n,* thence through the harness, and through the usual reed in the lathe *d,* where it is woven,—the woven fabric passing over the breast beam *c,* and thence to the cloth roller *b,* round which it is wound by the usual ratchet-wheel and catch, operated by any suitable moving part of of the loom. The position of the weighted arms *k, k,* and their transverse pressing bar *m**, depends upon the position assumed by the warp between

the two rollers *n*, and n^1,—the bar m^*, bearing on the warp at this point with a pressure invariably the same.

Now, suppose the bar m^*, to be in its lowest position between the rollers *n*, and n^1, (see diagram, fig. 2,) as the fabric is wound round the cloth beam the warp will be stretched, and as the warp beam is prevented from turning by the pallet lever *i*, excepting on certain occasions, referred to hereafter, the warp which had been previously drawn down between the two rollers will be gradually raised, as seen in fig. 3; thereby raising the bar m^*, and with it the levers *k*, *k*. Now the position of the lever *j*, depends upon that of the arm *k*, against which this lever bears, so that as the bar m^*, with its arms, is raised, the forward end of the lever *j*, will be lowered, passing from the drawn to the dotted position, where it is within the range of the finger f^*, on the lathe. So long as this lever remains elevated above the range of this finger, its position is undisturbed, and the pallet lever continues to prevent the warp beam from turning, and the warp consequently from escaping. The necessary amount of warp to take the place of that woven by the lathe, and taken up on the cloth beam, is supplied by the gradual rising of that portion of the warp depressed between the two rollers *n*, and n^1. When no more of this depressed warp, however, remains to be delivered out, it becomes necessary to abstract another supply from the warp beam, and it is at the point where the supply of warp between the rollers is exhausted that the forward end of the lever *j*, comes within the range of the projection f^*, of the lathe. This projection strikes the end of the lever *j*, and moves the pallet lever *i*, so that the lower projection a^*, moves out of gear, and the upper projection a^*, into gear, with the escapement-wheel *h*. The moment the projection f^*, is, by the forward movement of the lathe, free from contact with the end of the lever *j*, the weight on the pallet lever instantly restores the latter to its original position. On this sudden movement of the pallet lever, the escapement-wheel will be turned round to the extent of one tooth, and a limited amount of warp will be delivered off. The sudden letting-off of the warp does not in any way impair that uniform tension which is necessary for the proper weaving of the fabric, for the moment this slack is given out, it is taken up by the bar m^*, which depresses it between the rollers *n*, and n^1, as before; at the same time, by the depression of the arms *k*, *k*, the forward end of the lever *j*, is raised, and remains beyond the range of the projection f^*, until another supply of warp has to be obtained from the beam, which becomes necessary when the supply between the two rollers *n*, and n^1, has been expended. A repetition of the above-described movement then takes place.

The patentee claims, "First,—the general construction and arrangement of looms for weaving, as described. Second,—the system or mode of maintaining the warp at a uniform tension, by means of a pressure bar, in combination with two rollers, as described. Third,—the system or mode of letting off the warp from the warp beam, by means of an escapement-wheel and pallet lever, when the time for so letting off the warp is determined by the action of a pressing bar and rollers, or their equivalents, as described."

To JOHN LANG *and* CHARLES CHEVALIER, *both of Birkenhead, for improvements in targets.*—[Dated 25th February, 1860.]

THIS invention consists in constructing automatic and self-registering targets, so as to avoid the necessity for a marker or signalman being stationed at or near to the target or butt, for the purpose of signalling by flags the portion of disc or target struck by the projectile.

In Plate IX., fig. 1, is a back view of the improved target, the frame being withdrawn to allow of the working parts being seen; and fig. 2, is a vertical section, taken through the centre of the target, the supporting frame being shown in position.

The targets are formed of three separate plates A, B, C, exclusive of the "bull's-eye" plate D, which latter is also rendered separately self-registering; and these several plates, forming the target, are suspended from a strong supporting frame F, G, in the following manner:—Each segment or plate, independent of the bull's-eye plate, is carried by four arms H, H, I, I; two of the arms H, H, of each plate or segment are suspended from wrought-iron eyes K, K, bolted to the frame opposite the upper portion of each segment; these arms H, H, being hinged to the lower portion of each segment. The two other arms I, I, of each plate or segment are suspended from wrought-iron eyes L, L, bolted to the frame opposite the lower portion of each segment; these arms I, I, being hinged to the upper portion of each segment. The arms H, H, and the arms I, I, are of equal length, and are connected at the centre by a pin M, which is firmly fixed in each of the arms H, H, and moves in a slot in the arms I, I. This mode of suspension forms a convenient parallel motion, leaving each of the segments free to move only in a direction parallel to itself. The holes of the upper or lower hinges require to be slightly oval, so as to allow of the necessary amount of parallel motion. The arrangements of the levers and their connections, top and bottom, may, however, be reversed. The segments are pressed outward from the frame by springs N, N, the outward motion whereof is limited by a bar O, bolted to the outer arms H, H. A corresponding bar O^1, fixed to the arms I, I, helps to strengthen the construction. The separate suspension and support of the plate D, is provided for independently of that of the "centre" rectangular plate or segment, as shown in figs. 1, and 2, where one method is shown; two studs or projecting bolts, being secured to the back of the bull's-eye plate, may work in a tube or socket secured to the supporting frame F, G. At the base of this tube or socket a suitable spring, or a cushion of india-rubber or other elastic material placed there, would allow of the necessary amount of resilience; and by inserting a pin in each of the studs or bolts, which pin should work in slots formed in each of the sockets or tubes, the outward action of the spring could always be so limited as to keep the outside face of the bull's-eye plate D, flush with the face of the centre plate or segment C, or only so much in advance of it as may be desired. Small metallic springs E, E (by preference brass), are placed behind each of the pieces; these springs are insulated from the frame and iron pieces or parts of the target when the latter are pressed out by the springs N. To the springs E, are connected the conducting wires leading to the galvanic battery and indicating instrument, so that, each of the plates being furnished with its own special circuit and indicating needle, when a bullet strikes any segment it yields to the blow,

and comes in contact with the spring E, at its back, thus forming electrical connection, and completing the circuit; by merely looking therefore at the indicating instrument, the particular plate or piece of the target which has been struck by the bullet may be ascertained.

Fig. 3, is an elevation of a double dial and needle-indicating instrument as is hereinbefore referred to; both needles, however, are shown as deflected from their normal position, which need not be at one and the same time.

Fig. 4, is a transverse section of fig. 3, taken through the centre of the instrument case. It exhibits one of the forms in which such instruments are constructed for the purpose of recording two positions on each dial. It consists of a box or case containing two armatures, each surrounded with a coil in the usual manner, and supported as shown. Upon the end of each spindle which carries the armature is supported the indicating needle *b*. The face of the containing box is dialled, so as to enable four values of shots being instantaneously recorded, viz., "centre," "outer bottom," "outer top," and "bull's-eye." *c*, *c*, are small catches at the ends of each of the rods *d*, connected with a small spring attached to the supporting frame *e*, so that, by merely pulling the ring attached to the end of the spindle *d*, the needle *b*, may be released after each indication. *f*, is the outer glazed case or cover of the instrument; *g*, is a small sliding door at the back of the instrument, to allow of the adjustment of the interior apparatus.

Fig. 5, is a diagram exhibiting one mode of arranging the electric wires at the back of the target; s^1, being the earth wire, which is connected at t^1, t^2, t^3, and t^4, with the bull's-eye, and each of the main pieces of the target respectively; and u, u^1, u^2, and u^3, are four separate and distinct metallic wires, properly insulated, and connected at one end to each piece or part of the target, and at their opposite ends to a battery pole; and there may be two or more batteries placed close to the frame of the target. For the arrangement last described, the contact making is effected behind each piece of the target whenever it is struck, and although four battery wires are shown, two lengths of wire only are needed between the battery power near the target and the indicating apparatus at or near the rest or point from which the projectile is fired; a positive or a negative current, as the case may be, causing either of the needles to be deflected to the right or to the left by a single pulsation.

Fig. 6, illustrates a form of target, which is in this case circular (instead of the shape and proportions of the Government regulation targets just referred to), having a bull's-eye plate and four surrounding separate segments.

Fig. 7, is the indicating target, being divided out so as to form a facsimile of that which is being fired at, each of the divisions being provided with an index, and connected with the real target by wires and galvanic batteries, as previously herein described.

Fig. 8, is a circular target divided out, so as to have a bull's-eye plate and twelve surrounding divisions; fig. 9, being the corresponding index-board or miniature target,—each division having a needle or pointer.

Fig. 10, shows another mode or method of making contact between the metallic plate or piece of the target and the battery, each piece being suitably mounted independent of the others; and upon a blow being struck, it is communicated to the spring hammer, which in turn makes

contact, and so causes the current to flow along the conducting wire, and act upon the needle or pointer, producing a deflection. For effecting the indications by this method, instead of making the plates themselves moveable, and avoiding the necessity for their delicate suspension, the target plates are sometimes fixed to the framing with pieces of caoutchouc or other elastic packing between them and their seating; and behind each plate *a*, is a hammer-piece *b*, which is pressed by the spring *c*, against the back of the plate. At a little distance behind these hammers, insulated metallic points are fixed, and the hammers are connected to one pole and the insulated points to the other pole with an indicator in the circuit, as above described. The stroke of a bullet on the face of the plate causes one or more of the hammers in contact with that plate to fly backwards and strike the metallic surface or spring-piece *e*, behind them, thus completing the circuit and deflecting the indicating needle. In order to make the contact of the hammers with the points more certain, and to maintain that contact for a somewhat longer period, the metallic points are mounted on the ends of fine springs *e*, which yield to the hammers, and remain in contact with them during their deflection and recoil. For the purpose of measuring the time of the flight of the projectile, a stop watch may be used to note the difference between the time of firing and the vibration of the needle or pointer indicating the part or portion hit; and for more accurately determining the fractional parts of seconds of time occupied in the flight of the projectile, there may be employed, a double seconds' timekeeper, capable of being stopped and started by the respective acts of discharging the projectile and of vibrating the needle, by which the time can be read off; or by means of the traversing of a pencil over ruled paper, moved by clockwork,—or the traversing of geometrically divided paper in combination with a fixed pencil, producing a straight line,—or a moveable pencil traversing in a direction at right angles to the motion of the paper and producing a curve,—the minutest divisions of time may be accurately recorded. For the purpose of rendering the apparatus capable of registering the force as well as the position of the blow upon the target,—such indications being more or less approximate, whilst being uniformly correct within certain limits,—the following method may be resorted to:—To the back of each piece of a target a metallic projection is attached, of a curved or step-by-step form, the curved surface not being uniform, or the steps or notches should be made of different lengths, so that with a blow of small force one step or notch only or a small portion of the curve is brought in contact with a corresponding number or surface of terminal connected with the battery power; each separate terminal, when brought into contact by the increased force of the blow, brings into circuit an increased battery action, which is measured upon a galvanometer at or near the rest or point from which the projectile is fired. Thus, for the compound purpose of indicating the part of the target hit, the time occupied by the flight of the projectile, and the force of the blow struck, or either the first and second, or the first and third, the needles or pointers will require to be suitably connected to produce synchronic action.

The patentees claim, "First,—the construction of targets composed of several pieces (irrespective of their shape and configuration), and connecting each part or piece by means of electric, electro-magnetic, or galvanic apparatus, by means of two or more wires, with one or more needles or pointers, and by which the part of the target hit can be indicated or

recorded at or near to the point from which the projectile is discharged, or wherever else it may be desired to convey such indication. Second,—the construction of targets, as described, and connecting one or more pieces of such target by means of electric conducting wires with electric, electro-magnetic, or galvanic apparatus, or with a galvanometer of any suitable construction, either alone or in combination with a stop watch or apparatus, as described, for measuring and recording time, and for the purposes of measuring the force of the blow and the time of the flight of the projectile, or for either purpose separately."

To ALFRED VINCENT NEWTON, *of Chancery-lane, for an improved mode of, and apparatus for, fitting the abutting ends of the rails of railways together,—being a communication.*—[Dated January 5th, 1860.]

THE object of this invention is to cut the ends of T-rails for railroads, so as to form a peculiar kind of rebate or lap joint, by means of which the abutting ends of the rails may be securely united together.

In Plate IX., fig. 1, represents the two ends of rails after having been cut to the form required to produce the intended splice; fig. 2, is a side elevation of the machine employed for producing the lap joint; fig. 3, is a vertical section, taken at the line A, *a*, of fig. 2; and fig. 4, is a horizontal section, taken at the line B, *b*, of fig. 3. The same letters indicate like parts in all the figures.

One end of a section A, of the T-rail is formed by cutting out one half of its thickness for a distance of about six inches from the end, and about two-thirds the depth from the tread or upper surface to the bottom or the under face of the web, so that the recess formed will present a longitudinal vertical face a^1, in the plane of the middle of the thickness of the rail. The extreme end of the rail will present a plane at right angles to the longitudinal plane of the rail, and the inner end of the recess a vertical face d^1, parallel with the end. The bottom of this recess will present a plane b^1, which longitudinally is parallel with the tread or upper surface of the rail, and transversely a plane at an inclination to the base, so as to be lowest at its junction with the central vertical face a^1 and inclining upwards to the outer surface of the rail; at the cross section, therefore, this recess will present one half of what is known as a dovetail rebate. At a distance of one half the length of this recess from the end, the lower part or web of the rail is cut away, to form the plane b^1, in a vertical plane c^1, at right angles to the longitudinal plane of the rail; and the under face of the part which projects beyond the cross vertical plane c^1, is cut to a plane b^{11}, the exact reverse of the before-mentioned plane b^1, so that the cross section of this projecting part will present one half of what is termed a dovetail tenon.

One end of a section of rail being thus shaped, the adjacent end of the next section is cut the exact reverse thereof, so that the central longitudinal vertical plane a^1, of the one will come in contact with the corresponding plane of the other,—the end of the projecting part of the one against the cross vertical plane d^1, at the end of the recess of the other; the transverse inclined under face or plane b^{11}, of the one on to the inclined bottom b^1, of the recess of the other; and the cross vertical plane c^1, of the web of one

against the corresponding plane of the other; so that, when put together, the two sections will be completely locked, and prevent each other from moving vertically or laterally.

a, a, represent ways, to which are fitted a suitable carriage *b*, adapted to receive and hold a T-rail, as it is termed by railroad engineers, there being suitable clips *c, c, c, c*, on the carriage to extend over the web of the rail to hold it down to the surface of the carriage. This carriage is moved forward by a screw-shaft *d*, below the ways, the thread of which acts on a projection at the bottom of the carriage. The end of the screw-shaft has a cog-wheel *e*, which is turned one cog at each rotation of the main driving-shaft *f*, by a single spur on a wheel *g*, on such driving-shaft. Or the feeding motion may be imparted by any other suitable mechanical means adapted to impart an intermittent feeding motion at the end of each complete operation of the series of cutters to be presently described.

In the frame *h*, beyond the ways *a, a*, are mounted the stocks of four cutters *i, j, k, l*, adapted to slide in suitable ways, as represented. The stock of the cutter *i*, is secured to a metal strap *m*, which embraces an excentric *n*, by which the cutter is operated to give a vertical reciprocating motion to cut into the rail, as it is presented by the feeding motion of the carriage, beginning at the end, and by a succession of cuts removing the metal to form a rebate, and leave the vertical plane d^1, parallel with the end of the rail, and the longitudinal vertical plane a^1, in the middle of the breadth of the rail. This cutter is formed with a cutting edge at the lower end of its front face, to make the parallel cuts for theface d^1, and at right angles with the plane a^1, of the rebate or recess.

As the cutter *i*, begins to rise out of the way, the cutter *j*, moves forward, to insure the removal of the chip from, and give the required face to, the plane a^1, of the rebate. The cutter projects from its stock *o*, which slides horizontally in suitable ways, the motion being imparted by an excentric *p*, as in the case of the cutter *i*, by a connecting excentric strap *q*. This cutter is formed with its lower horizontal edge to go down to the bottom of the rebate in the rail, its cutting edges corresponding with the vertical plane *a*.

As this cutter *j*, is completing its cut, the third cutter *k*, begins to advance, so as to complete its cut just after. The cutter *k*, projects from its stock *r*, which slides in suitable ways, at right angles to the longitudinal axis of the rail, and at an inclination with the base of the rail, to correspond with, and form the inclined bottom b^1, of, the recess in the rail. The stock of this cutter is connected with, and receives motion from, an excentric *s*, in the like manner as the other cutters.

The fourth cutter *l*, which is mounted on a stock *t*, like the cutter *k*, is placed on the opposite side of the rail, and receives motion in like manner from an excentric *u*. It is also set at an equal but reversed inclination, and cuts away the under part of the rail to form the bevilled under portion of the rail, which projects beyond the cross vertical plane c^1, to fit on to the inclined bottom b^1, of the recess to be formed in the adjacent section of rail. Motion is imparted to the excentrics for operating the three cutters *i, k, l*, by means of a pinion *v*, on the main driving-shaft *f*, which pinion engages the cogs of three wheels *w, w, w*, one on each of the shafts of the excentrics *n, s, u*. The required motion is imparted to the excentric of the horizontal cutter *j*, by two bevil wheels *x, y*, one on the main driving-shaft and the other on the shaft of the excentric *p*.

The patentee claims, "giving to rails the form substantially such as herein described, by the combination of the series of cutters arranged in relation to each other, substantially as described."

To THOMAS WEBSTER RAMMELL, *of St. Alban's-place, St. James's, for improvements in pneumatic railways and tubes.*—[Dated 10th February, 1860.]

THIS invention relates to the conveyance of passengers, goods, parcels, or letters, by means of atmospheric agency through tubular railways. The rails, grooves, or trams constituting the way, are contained in tunnels or tubes, and the traffic is carried within and through the tunnels or tubes. The carriages upon or in which the traffic is placed rest and move immediately upon, and are directed in their motion by, these rails, grooves, or trams.

In Plate X., fig. 1, shows a transverse section of a tunnel as constructed of brickwork for an underground railway, for the conveyance of passengers and goods; and fig. 2, shows a transverse section.

The carriages have the same form in tranverse section as the interior of the tunnel at *b, b, b, b,* in fig. 1, and in order that a uniform clear space may be preserved all round, the carriage is framed out at b^1, b^1, in one or more places underneath. The vacant space left between the carriage and the tunnel is filled with a soft material, which is fixed to, and moves along with, one or more of the carriages, and which, in the passage through the tunnel, yields to any inequality in the interior surface. The soft material preferred for filling up the intermediate space left is some kind of matting made with a pile, and it is applied in strips of, say, a foot to fifteen inches wide, one or more to each carriage, to prevent undue leakage of air.

For propelling and working the train of carriages, pneumatic pressure is applied over the whole transverse area of the carriage, by rarefying and expelling the air in front of the train. For this purpose, a pump, worked by steam power, is employed, and by preference one upon the principle of the fan, in which the air is expelled or pumped out by the action of centrifugal force, but any other form of air-pump may be used.

The arrangements proposed for the practical application of the power, and the working and regulating of the traffic, are as follows:—Fig. 3, shows a plan of a portion of a single line of railway *a, a, a,* with a terminal station *b, b,* and an intermediate station *c, c.* The line is made double at the intermediate station, to allow the up and down trains to pass; the part *d, d,* being reserved for down trains, and the part *e, e,* for up trains. At the terminal and each intermediate station a steam-engine of the requisite power is erected, and in connection with it proper pumping machinery as above explained, working in a suitable exhaust chamber *f, f,* into which is conducted the end of a shaft or air passage *g, g,* g^1, g^1, proceeding from the tunnel at a point *z,* z^1, placed at some little distance, say, from fifty to one hundred yards from the station. In the air passage a screen-valve *h,* h^1, is placed, communicating between the tunnel and the exhaust chamber, and also another screen-valve *l,* l^1, communicating between the tunnel and the outer atmosphere, and both of which are made to open and to close, either by hand or automatically, as may be most convenient. Across the tunnel is placed at every terminal and intermediate station

valve doors k, k^1, k^{11}, covering the entire area of the tunnel, and opening outwards into the station. The stations are connected by electric wire or other telegraphic communication. A train being in readiness at the terminal station b, b, its head is brought up so as to be just within the mouth or extremity of the tunnel; the valve-doors k^{11}, are opened, and the valves h^1, and l^1, are shut. A signal is then given to the station c, when the valve doors k, k^1, are closed, the valve h, opened, and the valve l, shut. The engine and pump are then started, and by their action the air in the tunnel is quickly rarified, and motion communicated to the train by the superior pressure of the air behind it. As soon as the train has moved off into the tunnel and has reached the point z^1, the valve-doors k^{11}, are closed after it, and the valve l^1, opened, so as to admit a free supply of air behind the train, and avoid a rush of air through the station b, b. The train then soon acquires a high velocity, the air in front being drawn through the shaft and air passage g, g, at the station c, c, and that required to follow behind being supplied down the air passage at the station b, b, through the valve l^1, and this velocity is continued until the train has reached the point z, at the opening of the air passage g, at the station c, c. After passing this point, the power of the pumping engine acting, though in a less degree, behind, instead of, as before, in front of the train, has a tendency to draw it in the direction of the station b, b, and practically assists in bringing the train to rest. Almost immediately after the train has passed the point z, the valve h, is shut; but the train being carried onward by the momentum it has acquired, and compressing the air in the remaining portion of the tunnel, forces open the valve-doors k, and enters the station c, c, where, by the breaks, it is brought to rest—its head buffing against the air in the space in the next section of tunnel, as shown on the plan at m. The train remains in this position at the intermediate station so long as may be required, and is then ready to proceed to the next station in advance, in the same manner as has been already described, and so on from station to station. It will be seen, that while the engine and pump at the intermediate station c, c, are drawing an up train from the station b, b, they may at the same time be employed—by means of the corresponding valves and air passages in connection with the next length of tunnel, as shown in fig. 3—in drawing a down train from the station beyond, which will enter the station c, c, at the same time, and will occupy the down platform. Or two complete tunnels, with air passages, &c., may be placed side by side, and one of these may be used for up traffic and the other for down traffic. It is an essential condition for economical working that the sections into which the railway is divided should all be of nearly equal length.

Figs. 4, and 5, show a tube for the conveyance of small packages. The rails or grooves guiding and directing the motion of the carriage may or may not be part of the body of the tube or tunnel.

The following contrivance for gradually reducing the speed of the carriages on their approach to a station, and for bringing them to rest, is employed:—Instead of connecting the exhaust chamber with a single air passage proceeding from or leading into the tube, several smaller or branch air passages leading from the exhaust chamber, and entering the tube a, a, at different points b^1, b^2, b^3, &c., as shown in fig. 6, are used, the area of which branches collectively should be about equal to that of the tube. The effect of this arrangement will be, that while the car-

riages in their main course will be drawn towards the station with the full force of the pump, and full capacity of all the branches up to the point b^5, beyond that point the propelling power, and consequently the speed of the carriages, will be gradually reduced. For example, if there be five such branches, as shown in fig. 6, then, on passing the point b^5, the carriages will be acted upon only with the power due to the capacity of the remaining four branches. On passing the point b^4, they will be acted upon only with the velocity due to the capacity of the remaining three branches, and so on in succession. Under this arrangement, the retarding force due to the rarification of the air behind the carriages, as well as in front, so soon as they have passed the point b^5, may be allowed to act, and to assist in bringing the carriages to rest; but it is preferred that this should not so act, and to avoid it a self-acting valve is placed upon each branch at the point where it enters the tube, as shown in fig. 7, so contrived that the valve *d*, will open by the action of the piston *e*, shown in that figure, upon the power being turned on in the conveying tube through the valve *c*, shown in fig. 6, and will close again immediately after the passage of the carriages by the action of the balance-weight *f*. The valve *c*, in fig. 6, should be closed as soon as the self-acting valves *d*, *d*, &c., upon the several branches are opened. The valve *g*, corresponds to the valve-doors *k*, k^1, shown in fig. 3, and may be arranged so as to be kept shut during the approach of the carriage until it arrives at the point b^1, in fig. 6, or thereabouts, and to be then opened by any automatic contrivance. The velocities will then be regulated solely by the capacities of the several branches (as influenced by the pumps) and by the momentum of the carriage, and the carriage must, of necessity, be drawn home. It should be observed, that the capacity of each branch air passage may be determined either by the size of the pipe itself, or by the greater or less opening of the valve within it.

The patentee claims, "First,—the general combinations and arrangements above described with respect to pneumatic railways and pneumatic tubes respectively. Second,—a pneumatic railway or tube in which the carriages are placed inside the tunnel or tube, but are independent of the tunnel or tube, and are wholly supported, and in their motion are guided and directed, by two or more rails, grooves, or trams, and in which the pneumatic pressure is applied over the whole or transverse area of the carriage. Third,—the contrivance for filling up with soft material the space between the interior of the tunnel or tube and the outside of the carriage, as applied to pneumatic railways and tubes, as above described. Fourth,—the arrangement of a fan or centrifugal air-pump, or a steam jet with valves and shafts or air passages, as applied to pneumatic railways and tubes. Fifth,—the use of several smaller or branch air passages leading into the tube at different points, either with or without the self-acting valves, so as gradually to reduce the velocity of the carriages, as applied to pneumatic railways and tubes, as above described."

To JAMES DUNCAN, ALEXANDER SCOTT, *and* JAMES DAWSON, *all of Greenock, N.B., for improvements in reburning animal charcoal, and in the application of the products arising therefrom, and in the apparatus employed therein.*—[Dated 27th January, 1860.]

THIS invention relates to the treatment and reburning of animal charcoal, or what is generally known as ivory or bone black, or the carbonaceous matter which is ordinarily used in the refining of sugar, and in other chemical processes.

The object of the improvements is to treat the used animal charcoal in such manner as to admit of the free escape of the gaseous products arising from recalcination, and also to utilize these products, so as to economise the consumption of fuel, or apply them to the manufacture of other chemical products. In carrying this invention out in practice, it is preferred to use for the purpose a range or series of retorts or chambers for holding the used charcoal. These retorts are arranged in sets or "benches" of three, five, or other convenient number of retorts, and they are arranged in a vertical or horizontal position. The retorts are arranged in brickwork in the ordinary manner, and heated in the usual way by means of furnaces. These retorts, when they are disposed vertically, are left open at the upper part, for the purpose of charging the retort with the spent or used charcoal. Each retort has fitted to it a pipe, which is carried downwards into the retort, and terminates at or near the bottom. That part of the pipe which is enclosed within the retort has formed in it a great number of holes, which pass through the metal in a lateral direction. The upper portion of the pipe is extended so as to admit of its being carried into the shaft or chimney connected with the furnaces, or it is caused to communicate with other means for exhausting or drawing off the gaseous products. The whole number of retorts employed in the work are fitted as just described.

The animal charcoal which is to be treated according to these improvements, is first washed in water, to free it from the saccharine matter held in contact with it. The retorts are charged with the impure charcoal, and the heat of the furnaces is raised, so as to bring the retorts and their contents to a bright red heat. During this calcination, the animal charcoal contained in the retorts gives off a large quantity of gaseous matters, which, under the ordinary process of revivification, do not properly escape from the burning mass, and consequently the purity of the resulting product is injured. According to the improved mode of treatment, these gaseous products pass off through the perforations in the central pipe, and are conveyed away to the chimney. If the natural draft of the chimney is not sufficient to draw off the gaseous products with the requisite velocity, a fan wheel or air pump is arranged, so as to communicate with the chamber or reservoir into which the extremities of the perforated pipes are brought. Upon this fan or pump being put in motion, the gaseous products are drawn off as quickly as they are evolved from the burning charcoal, a gauze wire diaphragm or other suitable medium being interposed at a convenient part of each pipe, to prevent any portion of the solid particles from being withdrawn by the action of the exhausting apparatus.

In the case of retorts arranged horizontally, the gas tube is preferred to be disposed nearer to the upper part of the retort, and to pass out at the

back rear end of the retort, or other suitable part, and away to the chimney or exhausting apparatus.

In some cases, it may be preferred to have two or other convenient number of pipes passing through the charcoal, the diameter of the pipe or pipes being suited to the quantity of charcoal operated upon in each chamber or retort. The gaseous products so obtained may be utilized by conveying them into the furnace, and being there consumed, they assist in heating the retorts, and so economise the consumption of the fuel. Or, in lieu of this mode of disposing of the gaseous matters, they may be applied to the manufacture of sulphate of ammonia, and other generally similar chemical products.

The patentees claim, "First,—the system or mode of treating or reburning animal charcoal with the aid of the mechanical arrangement for withdrawing the gaseous matters, as described. Second,—the application to, and use in, apparatus for reburning animal charcoal, of a tube or tubes for carrying away the gaseous products evolved from the used charcoal, as described. Third,—the system or mode of collecting the gaseous matters evolved in reburning animal charcoal, and utilizing the same, either by causing them to assist in heating the retorts or applying them to aid in the production of chemical products, as described."

To CHRISTOPHER NUGENT NIXON, *of Ramsgate, for improvements in the construction of mangles, the same being also applicable to other machinery for the pressure of textile fabrics and other substances.*—[Dated 28th January, 1860.]

THIS invention relates to improvements in the class of mangles, known as "box-mangles," and also to "portable mangles." In constructing box-mangles, a rack is fixed to the top, side, or any other convenient part of the box, the teeth of such rack being placed obliquely. An endless screw, actuated in any convenient manner, gears into the teeth of the rack, and by its revolution causes the box to travel along the bed. Continuous to-and-fro motion of the box, while the screw rotates in one direction only, may be obtained by the employment of any of the known means for effecting such purpose. Instead of the above-mentioned arrangement of rack and screw, an endless screw may be fixed to the upper edge of the box, the same being actuated by a wormed nut fitting thereon, such wormed nut being firmly held in position by the requisite framework, but so as to allow of its revolving freely. At one or both ends of such wormed nut a bevil wheel or wheels or pinions is or are fixed, a bevil pinion, actuated by a handle, gearing into the same. In the construction of portable mangles, two rollers are arranged horizontally, one above the other, within suitable framework. The lower roller revolves in sockets, permanently fixed in the framework. The upper roller rotates by means of the spindle passing through the same in bearings, so arranged as to move vertically within the frame as required, the movement thereof being controlled by springs. The object of this arrangement is to allow of the passage of various thicknesses of material between the rollers. The framework should be so constructed as to permit the upper roller and springs to be removed, if required. To the spindle of the upper roller, and on the outside of the framework, is fixed a wormed wheel, into which gear a screw, for setting the machinery in motion.

Another mode of constructing the portable mangle is to place a flat bed or table beneath a single roller, or to place the roller between two beds or tables,—suitable means being adopted for the regulation of the distance between the tables and the roller, and for the maintenance of a proper degree of pressure. The roller may be actuated by either of the arrangements before mentioned.

The portable mangle may be also constructed and arranged as follows:—The rollers or single roller, and table or tables, are arranged as before described, the upper roller, or single roller (as the case may be), being made hollow, and the interior surface thereof formed with a spiral or wormed groove. An endless screw, actuated in the ordinary way, is fixed across the framework in a line axial to the roller through which it passes, a wormed nut being caused to work backwards and forwards on such screw, the said nut being provided with a screw thread on the exterior thereof, or with a stud or studs, working in the wormed groove in the interior of the roller, and thus causing the latter to revolve. In the application of this arrangement to box and table mangles, the working roller must be provided with a set of teeth on the central portion of the exterior thereof, the same gearing into a suitable rack fixed to the box or table.

The patentee claims, "Firstly,—the employment of screw or worm arrangements in the construction of box mangles, in manner described. And, Secondly,—the employment of screw and worm arrangements in the construction of portable mangles, in manner described."

To JOHN HENRY JOHNSON, *of Lincoln's-inn-fields, for improvements in the steeling and cementation of metals,—being a communication.*—[Dated 28th January, 1860.]

THESE improvements relate to the conversion into steel, or the steeling, of wrought or cast-iron articles, by submitting them to the action of certain vapours produced by the application of heat to mixtures hereinafter mentioned, or by the immersion of articles manufactured of wrought or of cast iron in the bath from which these vapours are obtained.

The bath which is employed to produce the vaporization is composed of charcoal dust, grease, and fatty matters of all kinds, animal and vegetable, together with fish oils, saltpetre, horn, or other azotized bodies, prussiate of potash, soot, sea salt, powdered slate and ores, burnt leather, black lead, and other substances of similar nature, but mixtures of these materials may be modified as required. The mixture preferred consists of—grease 500 parts by weight; oil 500; charcoal 350; prussiate of potash 250; horn 330; and salpetre 300.

By subjecting wrought or cast iron to this vaporization process, its conversion into steel is effected in a very short time, and the steel obtained is of superior quality, possessing a high degree of hardness, and equal, if not superior, to fine grained cast steel. It is a steel that is admirably adapted for the manufacture of articles of warfare, harness work, and for the several industrial appliances of steel. Rails, wheels, springs, and all other pieces and parts connected with or belonging to railways, which are subjected to great friction, and which are consequently soon destroyed, and require frequent renewal, may be hardened and converted into steel

by this process, thereby obviating the difficulties and inconveniences attendant on the use of iron.

Similar results to those obtained by the cementing process now in use, that is, steel of good quality, hard, ductile, and pliable, may be produced by plunging cast iron or castings into a bath prepared for the vaporization process. Two objects or two pieces of metal may be operated upon at the same time by immersing one of such objects in the bath before described, and submitting the other to the action of the vapours resulting from the bath by the action of heat, and their conversion may be effected in a few minutes. In the same manner and by the same process, ordinary steel may have imparted to it qualities appertaining to steel of superior quality.

The patentee claims, "the conversion into steel or the steeling of iron or of cast iron, and the improvement of ordinary steel, by subjecting them, or any of them, to the vaporization process, or to immersion in a bath prepared for the vaporization process before mentioned, in the manner and for the purpose described."

To CHARLES ANDRÉ CHAPUIS, *of Paris, for a new or improved process in manufacturing and ornamenting ceramic products chemically.*—[Dated 7th March, 1860.]

THE following is the specification of this invention:—"The magnificent Chinese porcelain is the result of processes and a manufacture unknown, excepting in China. Neither savants nor manufacturers of porcelain—not even the celebrated manufactures of Sèvres china,—have been able to discover the processes by which these beautiful crackle vases, with the mosaic designs, are produced—objects of art so much sought after by connoisseurs. Certain experiments have led me to discover principles and processes applicable to this branch of the art of manufacturing china, earthenware, or porcelain.

"My invention consists of a new mode of decoration, which I apply to ceramic objects, taking advantage of the porosity of their material, and also of their coatings, for the application of the metallic solutions hereinafter mentioned.

"By means of these processes, I produce a regular decoration on large vases, and other objects having a mosaic character, and possessing all the appearance and properties of crackle china. For the purpose of obtaining designs in crackle china, mosaic, and other various decorations, I impregnate these bodies alternately in a hot and cold state, with ammoniacal or alkaline salts, or with acidulated liquids holding metals in solution, the nature and employment of which I determine according to the colors I wish to produce. For this purpose I make use of heating apparatus, of cast iron or other metals. The metals which I employ in solution are iron, copper, silver, platina, and others, such as rhodium, iridium, palladium, osmium, ruthenium, and, in fact, all matters known in chemistry, and applicable for the purpose."

The patentee's claim is, "a new mode of decoration applied to ceramic objects when once manufactured, advantage being taken of the porosity of their material, and also of their coatings under the influence of the metallic solutions, as above described; by which new mode of proceeding is

produced a regular decoration on large vases and other objects having a mosaic character, and possessing all the appearance and properties of crackle spotted china."

To James Wright, *of Bridge-street, Blackfriars, for an improved method, means, and process of treating wood, so that it becomes so changed as to be well adapted for uses for which it is naturally unfit,—being a communication.*—[Dated 13th March, 1860.]

This invention relates to a peculiar mode of treating wood, by means of which its properties are so changed as to produce a substance capable of being substituted for more expensive materials used in the production of various articles. The resulting product being extremely dense and hard, it is capable of resisting to an extraordinary degree wear and friction, and will be found valuable as a cheap substitute for horn, to be made into buttons, handles for cutlery, utensils, and such like articles; also as a substitute for gun metal, alloys, and other metals, and as bearings for the motive parts of machinery; for printing types; for pavements, building and architectural purposes; to take the place of leather, in the heels and soles of boots and shoes; and other matters in the arts and manufactures.

The invention consists in submitting wood to the action of heat while confined in a compressed state within a mould, and also in impregnating it, either wholly or partially, with resinous, oily, or other moisture repelling substances, or with metallic or mineral salts, or with any other preservative chemical or dyes. The action of heat upon wood, while confined in a compressed state in a mould, is to materially increase the hardness, which would result simply from compression alone. Decay of the wood is also in a great measure arrested and prevented, and its natural elasticity either wholly or partially destroyed, according to the extent to which the process is carried. If the articles to be made from the wood are to be finished or nearly so in the mould, then the wood, previous to compression, should be cut into shapes of such size and form as experience alone can determine for each different article. But if the articles to be made have to be shaped by cutting, or other tools, subsequent to the compression of the wood, then the shape and size of the block of wood may be of any suitable and convenient size and form.

The shapes or blanks of wood are submitted to the action of high-pressure steam, within a strong closed vessel, whereby the wood is perfectly seasoned, and by the condensation of the steam within the vessel, a vacuum is obtained in the pores of the wood. After the vacuum has been obtained, oily or resinous or other waterproof material, or any metallic or mineral salts, or other preservative chemical, is run in a liquid state into the vessel, or any desired dye, or other matter, in accordance with the requirements of the article to be made from the wood, is admitted to the vessel. In some cases, mechanical pressure, in any required amount, is supplied to assist the injection. When the blanks are removed from the vessel, they are submitted to the action of heat, so as to drive off from the wood any moisture which may be thereon, and any solvent of the injected matter which may be contained. The blanks of wood are now compressed into moulds by a screw, or any other suitable means. Before the action of the press upon the wood is removed, the moulds or the moveable parts thereof are locked or bolted, so that the

wood cannot recover any of its original bulk by virtue of its elasticity. The moulds, with their contents, are next removed from the press, and submitted to the action of heat in an oven. From 200° to 500° Fahr. may be used for the purpose of heating and hardening the wood confined in the moulds, with good results; but this temperature may be varied for the different varieties of wood, and for the different uses to which the product of the process is to be applied.

The patentee claims, "The method or process herein described of treating wood, consisting in compressing it within moulds, and afterwards heating it while confined and under pressure. And also the process of treating wood by impregnating it with steam and resinous, oily, or other waterproof matter, and mineral or metallic salts, and preservative chemicals and dyes, or any of these, or their substantial equivalents, prior to and in combination with the process above named."

To William Tuxford, *of Upper Thames-street, and* George William Hills, *of Mortlake, for improvements in furnaces.*—[Dated 10th March, 1860.]

This invention consists in substituting for metallic fire-bars, bricks or slabs made of any kind of fire-resisting earth. The bricks or slabs are made of any suitable length and width, to suit the dimensions and form of the furnace; and these bricks or slabs will contain a sufficient area of perforations in accordance with the requirements for a convenient draught. The thickness of the bricks or slabs is preferred to be three inches; they are placed in layers of three, exactly over and upon each other, so as to make the perforations correspond, by which means air passages of nine inches are formed, such air passages having a diameter of two inches for the two lower layers, whilst the perforations in the top layer will be two inches at bottom, and reduced gradually to one inch and a half at top, in order to prevent as much as possible the choking of the passages by the falling of the ashes. The bricks or slabs may be made with tenons and slots, in order, if required, to secure them better together. The supports upon which the bricks or slabs may be placed can be made in any suitable manner. The object of the invention is to concentrate the cool feed air into the narrow passages which are formed as already mentioned, thereby causing a strong draught of air to pass into the fuel, whereby a better combustion, and accordingly a saving of fuel, is obtained.

The patentee's claim is, "the substitution for metallic fire-bars of a bed of perforated bricks or slabs, formed of, and applied, as already described."

To George White, *of Dowgate-hill, for applying as a substitute for the animal albumen, hitherto obtained from birds' eggs or blood, certain parts of reptiles, fish, mollusca, and articulated or radiated animals,—being a communication.*—[Dated 16th March, 1860.]

The object of this invention is to provide a substitute for the animal albumen hitherto obtained from birds' eggs or blood, which substitute may be procured in great abundance, particularly near the sea shore, so as to be had at a much lower price than the albumen from birds' eggs or blood hitherto solely made use of for industrial, culinary, or other purposes.

The invention consists in employing the animal albumen contained in the roes, spawns, eggs, or other albuminous parts of fish, frogs, or other cold-blooded or amphibious salt or fresh-water animals; thus, for instance, the patentee makes use of the roes, spawns, or eggs of all sorts of fish, frogs, or reptiles, the albuminous parts of the bodies of the animals called by naturalists medusa, physalia, parpita, velella, rizostom, aurellia, cyanea, solen, cardium, or other analogous species, which albumen has hitherto generally been lost, or at least not procured for the purposes above mentioned.

For obtaining the albumen from the albuminous parts of the abovementioned animals, the bloody, fleshy, or cuticular parts adhering thereto are cleared away therefrom, and the remainder is either triturated and crushed till a sort of albuminous pap or pulp is obtained, from which the albumen is then pressed or strained out, or the roes, spawns, eggs, or other albuminous parts, after having been properly cleaned from the bloody, fleshy, or cuticular parts, may at once be submitted to a suitable pressure or straining, so as to separate therefrom the albumen contained therein; or a small quantity of water or other suitable menstrum may be added, in order that the albumen may the easier be pressed or strained out. The albuminous liquid, thus obtained, is left to stand for some time, and the supernatant liquid part is drawn off from the sediment, and may be made use of in that state, or it may be brought to dryness by evaporation. As this albumen does not differ essentially in its composition from that hitherto obtained from birds' eggs or blood, the same may serve for any industrial, culinary, or other purposes, for which this latter was hitherto employed, such, for instance, as printing, dyeing, or imparting a glossy surface to fibrous materials, yarns, or fabrics for papermaking; for making pastry, or for other culinary purposes; for fining or clarifying wines, saccharine, or other suitable solutions or liquids.

The patentee claims, "applying for industrial, culinary, or other purposes, as a substitute for the animal albumen hitherto obtained from birds' eggs or blood, the animal albumen extracted from the roes, spawns, eggs, or other albuminous parts of fish, frogs, reptiles, mollusca, or other suitable cold-blooded or amphibious articulated or radiated animals."

To Thomas Richardson, *of Newcastle-on-Tyne, for improvements in treating organic and other substances containing phosphate of lime.*—[Dated 16th March, 1860.]

This invention consists in treating substances containing phosphate of lime with sulphurous acid, in order to produce a soluble phosphate of lime; also, in treating bones with sulphurous acid to obtain the animal matter free, or nearly free, from earthy matters; and likewise, in mixing porous materials with guano previous to decomposing it by means of acids, either *per se* or mixed with porous materials.

In carrying out his invention, the patentee mixes Peruvian or any other kind of guano with one-third of its weight of sawdust or any other porous material, thoroughly moistened with water, and throws the mixture on perforated shelves in a wooden or stone box, similar to those in use in the manufacture of bleaching powder, or in the purification of coal gas; he

then passes a current of cold sulphurous acid gas over and through the mixture until all, or nearly all, the phosphate of lime is dissolved in water. The mixture is then to be withdrawn and replaced by fresh charges. This mixture will be found to possess increased value as a manure, and may be used in the same way as the original guano.

He also prepares a soluble phosphate of lime from bones, bone ashes, apatite, or coprolites, in the following manner:—A series of towers or condensers, similar to those in use for condensing muriatic acid, are employed, but instead of leaving the whole space of the condenser open from top to bottom, it is divided about every four or five feet by means of a stone diaphragm perforated with holes. Openings are made in the side of the condensers, corresponding with the level of these partitions or shelves, for filling and removing the materials. These condensers are also connected alternately at top and bottom, to permit of a stream of cold sulphurous acid gas (obtained from any of the well-known sources) to pass through, and which, if any escapes condensation, may at last be conveyed and mixed with the hot gases passing to an ordinary sulphuric acid chamber. The different partitions of the condensers being filled with the material to be operated on, a small stream of water is run on while the current of sulphurous acid gas is being drawn through by the action of the draft of the chimney, with which the towers are to be placed in connection. The sulphurous acid is absorbed, and combines with one equivalent of the lime in the phosphate, which sulphite of lime, along with diphosphate of lime thus formed, dissolves in the liquid sulphurous acid, and is run off at the bottom of the condenser. If the solution does not stand as high as 15° Twaddell, it may be pumped up by suitable machinery to the top of the condenser, and substituted for the water which is employed for condensing the acid gases. The solution having acquired a strength of about 15° Twaddell, it is heated in furnaces, pans, or cisterns, by steam or otherwise, until all the phosphoric acid is precipitated as diphosphate of lime, which may be employed in that state as a manure; or, having ascertained by analysis how much lime is in combination with the phosphoric acid, as much sulphuric acid is added as will combine with from one-half to the whole of the lime. The greater part of the lime is precipitated as sulphate, which is either removed by subsidence, or the water is evaporated off till the mass acquires a pasty consistence. The contents of the pan or furnace are then dried up, by means of sawdust or any other porous organic material, and the resulting mixture is employed as a phosphatic manure.

When acting on bones, and the liquid which comes from the condenser falls in strength, indicating that the whole or nearly all of the earthy matter has been extracted from the bones, the side doors already mentioned are opened, and the animal matter removed. It is then dried, and may be afterwards used for the production of glue or size. The weak liquors, as they run from the condensing towers, are conveyed to a cistern filled with phosphatic material, through which they are allowed to flow, to enable the free sulphurous acid to act upon the phosphate of lime in the bones, previous to being pumped up for use in the towers, which are to fill the condensers. It is advisable to crush the bones, so as to expose them more effectively to the action of the sulphurous acid, and, for the same reason, it is preferable to soften them also by immersion in tepid water for some time before placing them in the towers.

In operating on bones, it is essential to prevent either the gas or the liquid becoming hot enough to soften or dissolve the animal matter.

In treating guanos with sulphuric acid, especially those, which, like Peruvian, contain a large per cent. of ammonia, the heat generated by the sudden chemical action has a tendency to throw off a large quantity of the ammonia, while the earthy matters, run into knots covered with a coating of gypsum, prevents the full action of the sulphuric acid on the phosphates. Both these objections to the use of sulphuric acid may be obviated, either by mixing the guano with about one-fifth of its weight of sawdust or other porous organic materials before adding the acid, or by dividing the porous material between the acid and guano, and then adding the mixtures of acid and sawdust to the guano and sawdust, and thoroughly incorporating them.

The following proportions it is prefered to use when treating Peruvian guano:—20 cwt. of Peruvian guano, mixed with 4 cwt. of sawdust or other organic drier, and 7 cwt. of sulphuric acid of 1·500 sp. gr. afterwards added; or, 20 cwt. of guano, to which is added 2 cwt. of sawdust or other organic drier, and intimately mixed with 2 cwt. of sulphuric acid of 1·500 sp. gr. to 2 cwt. of sawdust or any other organic drier. When muriatic acid is employed, the same process is observed; an equivalent quantity of the acid being used in place of the sulphuric acid.

To WILLIAM EDWARD GEDGE, *of Wellington-street South, for a liquid or novel preparation to be applied to wools,—being a communication.*—[Dated 3rd March, 1860.]

THIS invention relates to a novel preparation or compound to be employed in "oiling" woollen yarns or fabrics, and consists in dissolving colza, olive, or other suitable oil in liquid ammonia. After the dissolution has been completely effected, water is to be added, to render it sufficiently liquid to facilitate the subsequent repartition or separation of the fibres of wool equally and intimately. The quantity of water to be employed must depend upon the quality and purity of the oil; thus, pure olive oil will absorb a much larger quantity of water than colza or other ordinary oils, so that it is more economical than cheap oils, and preferable to the oiling compositions hitherto employed. The proportion of water may vary from a hundred to a hundred and fifty per cent. to the ammoniacal preparation.

This composition is prepared in the cold state; its preparation is neither long, onerous, nor difficult, and the composition offers no temptation to theft, does not injure the clothes of the workman, and leaves no hurtful trace of its passage, as its three elements form a homogeneous mass or liquid, having all the unctuous properties of the present oil without its inflammability or liability to coagulation; in fact, it diminishes the inflammability of wood or other substance on which it may be spilt, and coagulates with much less facility than oil.

This composition is to be employed for the carding and combing of wool in the same proportions as olive oil, and will not be found to injure the softness of the wool. Woollens treated with this composition are more easily scoured than when the ordinary oiling preparation is employed.

The method preferred by the inventor for the preparation of this improved oiling composition, is to pour into fifteen parts by weight of oil one part by weight of ammonia, gradually or in small quantity at a time, the oil being constantly stirred; about ten minutes afterwards, from fifteen to twenty parts by weight of water are added, the mixture being stirred while the water is being poured in, until it is sufficiently limpid to pass through the oiling apparatus. The vessel containing the composition is then covered during a quarter of an hour, and the operation is complete.

The patentee claims, "the employment of ammonia in combination with oil and water, as above described."

To CHARLES FREDERICK BIELEFELD, *of Gower-street, for improvements in the manufacture of wads for guns, and in cases for containing the charge of powder for the same.*—[Dated 9th March, 1860.]

THIS invention consists in moulding fibrous and cementing substances into gun wads, and into cases for containing the charge of powder for the same. The fibrous and cementing materials and relative proportions thereof used for these purposes may be greatly varied, but the inventor prefers to employ such cementing materials in conjunction with vegetable or animal fibrous substances as will not, when once formed and pressed into form, be liable to shrink by heat in hot climates, or to expand by moisture. The composition recommended for these purposes is as follows:—10 lbs. of vegetable fibrous substances, such as short or waste tow, or such like cheap fibres; 12 lbs. of flour or rice, made into a thick paste, using about six parts by weight of alum therein; 7 lbs. of rough turpentine, and one-third of a lb. of boiled oil. To this compound clay may be added, to obtain any desired consistency. Tallow, stearine, and wax, as well as other matters may also be employed.

In selecting materials for the purposes of the invention, it must be kept in view that the materials used should be such that, when made up, and pressed into wads, they shall present great strength with little liability to chip or crack, and at the same time that the wads shall be as little as may be liable to shrink or expand by heat or moisture.

The fibrous substances and cementing materials are ground together in a suitable mill, in order that they may be intimately mixed and rendered into a stiff plastic state; they are then to be moulded and pressed into the forms desired.

The moulds used are cylindrical on the interior (when cylindrical wads are required), the bottoms thereof being made to fit therein in a suitable manner, to admit of their being raised up through the moulds to deliver the wads as they are made. The upper parts or rams of the moulds are made in a suitable manner to admit of their being pressed into the moulds. The upper and lower parts of the moulds are formed to produce the desired concavities and other proper surfaces to the upper and lower sides of the wads; and the sides of the moulds are made plain or with grooves or projections, to produce wads to fit the rifling of the cannon or guns, or the moulds are made suitable in section for producing wads for Whitworth's and such like cannon and guns. It is preferred to

use three sizes of moulds for the same wads, the diameter of the first mould used being larger than the desired wads, so that the wads may, in the first instance, be comparatively roughly made, and then allowed to dry and set, after which they are to be again pressed in the second mould only very slightly larger than the desired size; the wads are then to be again dried in a drying room or stove, which is to be heated to a higher degree of heat than the wads are ever liable afterwards to be subjected to. The wads are then each to be pressed into a mould corresponding in diameter with the exact size of wad desired. This, however, is not essential, as wads may be produced of the proper size by using only one mould, in which the wads are made by first pressing in the plastic compound, and then, when the same has been dried, the wads are to be covered with a sheet of like material, or of canvas or other suitable material, and then again introduced into the same sized mould, and well pressed therein.

This invention is peculiarly suitable in cases where wads of wood for shells have heretofore been used, but other forms of wads for cannon and other guns may be similarly made.

In making cases for containing a charge of powder for guns, the invention consists in moulding like plastic materials into cases of a size, in each instance, to contain a charge of gunpowder. For these purposes moulds are provided, each suitable for making a half or other sectional part of a case, and by preference the plastic material is coated on both sides with canvas or other woven fabric. The sections of a case being thus moulded, they are combined into cases by means of suitable glue or cement, which will not be injuriously acted on by moisture.

The peculiarity of the first part of the invention consists in moulding and pressing plastic materials composed of fibres and cementing or adhesive substances into wads for cannon or other guns.

The peculiarity of the second part of the invention consists in forming cases to contain charges of gunpowder by moulding, as herein described.

To JOSEPH BROEL, *of Manchester, for certain improvements in the manufacture of soap,—being a communication.*—[Dated 5th March, 1860.]

THIS invention consists in an alteration of the process in the manufacture of soap, whereby considerable economy is effected both in time, labor, and fuel, and also further saving is effected, inasmuch as there is little or no waste of the lyes. The improvement is effected by blending or bringing together the different materials employed, whilst in a boiling state, and in such quantities as to form soap at once, in contradistinction to the methods employed at present in "soap-boiling." In the manufacture of common yellow soap (for example), which may be made either with tallow, common fat, or palm oil, or cocoa-nut oil, with the addition of resin, the inventor takes about 174 lbs. of tallow or other fats, and adds thereto about 96 lbs. of resin; he then, in about 24 lbs. of boiling water, slacks about 30 lbs. of fine lime, and when sufficiently slacked he pours in water to make in all about 400 lbs. or less; he then adds 196 lbs. of soda, and allows it to dissolve, stirs the mixture, and boils up well, and strains the solution or lye so made through a sieve (of about 80 meshes to an inch,) in order to keep back the sediment of the lime, and allow the lye to fall into the vessel of tallow and resin, continually stirring

the materials together, when they will be converted into soap. When this soap has cooled, it is to be boiled up again, to bring it into a liquid state, when it will be ready to pour into the "soap frames," where it is to be allowed to cool. If it is desired to make the soap dry quicker, a less proportion of water is used. Although the process is here described for the manufacture of "yellow soap," yet, with slight alteration in the ingredients, it is equally applicable to all descriptions of soap.

For white curd soap take 270 lbs. of tallow, or for a better quality 300 lbs. of tallow, to which, when melted, add the lye prepared of 30 lbs. of fine lime, about 190 lbs. of soda, and about 300 to 350 lbs. of water. This soap being allowed to cool and then heated to the liquid state, and poured into the "forms," will yield, when dry, a clear and hard quality of washing soap.

The patentee claims, "blending together the several materials employed in a boiling state, and in such quantities as to form soap at once, in contradistinction to other methods at present in use."

Scientific Notices.

TRANSACTIONS OF MECHANICAL ENGINEERS' SOCIETY.

At the Annual Provincial Meeting of the Members, held in the Lecture Theatre of the Midland Institute, Birmingham, on Wednesday, 8th August, 1860, James Fenton, Esq., Vice-President, in the Chair, the following paper, "*On the ten-yard coal of South Staffordshire, and the mode of working*, by Mr. William Mathews, of Corbyn's Hall Iron Works, Dudley, was first read.

In the present paper it is not proposed to enter into any elaborate or scientific discussion of the South Staffordshire coal field, but simply to describe that most important portion of it known as the thick, main, or ten-yard coal—a seam peculiar to this district, nothing similar having been found in this country, or indeed in any other part of Europe, and on the occurrence of which the importance of the district, as well as its high character for the manufacture of iron, is chiefly founded. For this object it will be convenient to consider the subject under the following divisions:—

I. Geological character and extent of the South Staffordshire coal field, and of the thick coal particularly.
II. Mineralogical peculiarities of the thick coal.
III. Modes of working the thick coal, and methods of ventilation.
IV. Area of thick coal remaining unworked, and its probable duration at the present rate of working.

I. The South Staffordshire coal field has been very closely investigated and described, not only by local men of intelligence and science, but more elaborately by Sir R. I. Murchison, in his *Silurian System*, and by Mr. Beete Jukes, in his recent volume on the *South Staffordshire Coal Field*, 1859, which exhausts all the knowledge at present attained on the subject. This coal field comprises the whole

mineral basin of South Staffordshire and East Worcestershire, which is flanked by the great red sandstone faults of Great Barr and Cannock Chase on the east, and of Stourbridge, Kingswinford, and Wolverhampton, on the west, which, by their junction on the north and south, limit the coal field in those directions. The extreme length north and south is about 26 miles, and the width at the widest part about 6 miles, giving an area of 90 to 100 square miles. The whole coal field rests unconformably on the upper silurian limestone, which comes up to the surface at several points, rising at the Wren's Nest Hill and Segley Beacon to an elevation of 730 feet and upwards above the sea level.

The region of the thick coal occupies the whole of the southern area of the field. In the northern portion of the stream, namely, that east of the Dudley limestone ridge, the working operations have been actively carried on for a long series of years; and it is on the southern portion that the district has now to depend for its chief supply of thick coal. In this portion of the district only are the limits of the thick coal still undefined, no proofs having been made further south than those at Cradley, Corngreaves, and Hawn, near Halesowen, where the seam exists in perfect regularity, dipping slightly southwards. To what extent, therefore, the thick coal may extend in this direction, what may be its quality or character, or what the difficulty of winning it, are problems yet to be solved. The extension of railways, however, into that locality, for which acts have been recently obtained, coupled with the pressing wants of the neighbouring ironworks and the rapid exhaustion of the thick coal in other portions of the seam, must effect this solution at no very distant day. The disfigurement of the landscape follows as a natural result: already some of the fairest portions of that neighbourhood are invaded by the inexorable march of mineral operations, and the classic scenes of Hagley may ere long give place to the unsightly appliances and ungenial aspects of the dark genii of the coal mines.

The northern limit of the thick coal may be roughly defined by a line drawn from Monmore Green eastwards, a little north of Bilston, to Darlaston, whence the boundary trends in a southerly direction to Westbromwich, where the coal is terminated by the Great Barr sandstone fault before mentioned, which forms its eastern boundary; the Kingswinford sandstone fault forming the natural boundary on the west. Whilst, however, the thick coal generally prevails over the area above indicated, it is by no means uniform and unbroken in its distribution. The boundary is somewhat modified by a termination of the bed by outcrop in some spots, short of the sandstone faults; and the general uniformity of the seam is materially dislocated and disturbed by the intrusion of the igneous rocks of the Rowley hills and at other spots, and incidentally of the subjacent measures, as well as by the occurrence of faults more or less extensive. A great anticlinal axis, running nearly north and south from Wolverhampton, east of Halesowen to the Lickey Hill, cuts the thick coal into two nearly equal divisions—one lying to the east of Dudley, the other to the west—forming two separate districts. These districts are subdivided by minor disturbances, forming other separate local basins, which are again intersected in various directions by faults and dislocations that have the

effect of further subdividing the seam of coal into separate areas or patches of a comparatively limited extent, so as to interpose difficulties of a serious character to its effective working; difficulties which will have to be discussed more in detail presently, and which are only compensated by the great value of the seam itself.

II. It is not within the province of this paper to suggest any theory as to the geological origin of the thick coal: this has been done with great ability and originality of view by Mr. Jukes, in his recent work. With us its existence is a great fact; and until we have to grapple with it practically, this is all that concerns us. It may however be mentioned that Mr. Jukes considers the bed of thick coal to have its origin physically in the close approximation of a number of seams of varying thicknesses, brought into contact by some fortuitous process; and this view is supported by the fact of the bed being divided by distinct partings into the several divisions constituting its entire thickness. It is further strengthened by the well-grounded supposition that the several portions of the thick coal in the Bilston district can be identified with a separate series of thin coal seams in the Wyrley district, into which they have extended; and further, by the fact that in other parts of the district the coal called the flying reed, consisting of the two top measures of thick coal, is gradually separated fram the main bed by the intrusion of many yards of various rocks, forming thenceforth an independent workable seam of thin coal. The several divisions of which the thick coal is composed are too strongly defined to admit of much difference of opinion as to the soundness of this theory.

A certain local nomenclature, by which these divisions of the thick coal are distinguished, has been adopted by the colliers, varying somewhat in each of the two districts, which is shown by the sections of the thick coal given in appended tables.

The character of the coal in these several divisions, and the greater or less thickness of the partings, materially influence the cost of getting the thick coal, as well as its marketable value, which is subject to great variations under the same, or nearly the same, conditions of the market. Hitherto this coal has been found of the highest excellence on the northern extremity of the basin; and it is there that the earliest workings commenced, partly by reason of its accessibility, but chiefly from the excellence of its quality at the outcrop. In that portion of the district lying between Wednesbury and Bilston, on each side of the main north road, known as Wednesbury Old Field and King's Heath, the vestiges of old workings, which are known to have been in operation as early as the year 1315, are spread over a large area. In 1577, deaths are recorded of men killed in the coal pits at Wednesbury. The method of working appears to have been by means of what are called "bell pits," in which, after the pits were sunk, the coal was excavated as far round the bottom of the shaft as could be done with safety; and when all the coal that could be thus worked was abstracted, other pits were sunk, and subjected to the same process. As the coal was shallow, and the sinking therefore inexpensive, the cost of getting by this mode was very moderate.

The invention of the steam-engine, and its application to the process of pumping the water from the mines, soon placed this rich district

under more extensive requisition; and the excellent quality of the coal commanded for many years a high price in the market; for household purposes, the celebrated Wednesbury thick coal being noted far and wide. In addition to these ancient Wednesbury workings, the coals of which do not at this period appear to have been applied in any way to the manufacture of iron, operations in the thick coal were carried on to some extent on Pensnett Chase, in the western portion of the district; and it was in this locality that Dud Dudley tried his first experiments in iron making. He says, writing in 1665,—"There are at least, within ten miles of the castle of Dudley, twelve or fourteen coal works, some in Worcestershire and some in Staffordshire, now in work, and twice as many not in work, each of which gets two thousand tons of coal yearly, and some three, four or five thousand tons of coal yearly; and the uppermost or top measures of coal are ten, eleven, and some twelve, yards thick; the coal ascending, basseting, or cropping up to the surface of the earth, and there the colliers formerly got it; but where the coal is deep, and but little earth upon it, there the colliers rid off the earth, and dig the coal under their feet: these works are called 'foot rids.'"

There is a marked distinction in the mineralogical character of the thick coal in the two portions of the district. In the Wednesbury district, the coal in the greater portion of the beds is generally of a more compact and crystalline character, breaking up into large cubical fragments, burning with a strong heat, and leaving a comparatively small residuum of ash. It is therefore better adapted for domestic use or gas making, and commands, in consequence, a higher selling price. An exception must be made, however, in respect of the coal in the Oldbury district, where, owing probably to the proximity of the basalt of the Rowley Ridge on the west, and the red sandstone fault of Westbromwich on the east, the quality is much deteriorated; the coal possessing neither the requisites of a good house coal nor suitability for iron smelting, and reaching therefore scarely half the value per acre of the same seam in the Wednesbury district. In the region west of Dudley, although the qualities ascribed to the Wednesbury coal attach in some degree to a portion of the thick coal, yet, generally speaking, it has a more dark and earthy texture, breaking with a tough and fibrous, rather than with a short and granular, fracture, and exhibiting clearer indications of vegetable origin. It is therefore better adapted for iron smelting, and has been held in higher estimation for that purpose from the days of Dud Dudley downwards; the pig iron made there being generally better in quality from the same ores where this coal is used.

For the purpose of working the thick coal, any given area may be taken, say 20 acres, included within any of the known faults which have been ascertained and laid down with so much accuracy by Mr. Jukes. The first step will naturally be to ascertain the inclination or dip of the coal, and the probable extent of water to be encountered, and then to mark out the proper site for two or three shafts. This done, it is necessary to erect a steam-engine of the requisite power, not only to wind up the coal from any probable depth when won, but also to pump whatever quantity of water the mine may yield. Two shafts are usually sunk of 7 or 8 feet diameter and about 24 feet apart, which are ventilated by drifts from one to the other as the sinking proceeds.

In case of much water being found, a third shaft is sunk, into which the water from the other two is conducted and pumped up to the surface; or else the water is coffered out with brickwork, which serves the same purpose as iron tubing, whereby the water is stopped back to prevent it flowing into the shafts at all. It is usual to sink one of the shafts a little lower than the coal, to provide what is called "sump room" or space to hold any small accumulations of water the mine may yield, from which, when there is no need for a pumping apparatus, the water is drawn by barrels as often as is requisite. For ventilation, one of the shafts is appropriated as a downcast, through which the fresh air enters the mine; and the other is the upcast shaft, up which the vitiated air that has passed through the workings is conducted; and a communication, closed by doors, is made between the two shafts. When all is completed relating to the shafts, and a stable for the horses excavated in the coal near the bottom, the next process is driving out the gate roads along which the coal is conveyed, and the air heads through which the foul air is brought back from the workings to the upcast shaft.

The gate roads are cut 9 feet high and 9 feet wide; and this is effected by the pikeman undergoing or cutting the coal horizontally at the bottom, excavating 4½ feet inwards 8 feet in width, making 36 square feet by 18 inches thick, for a "stint" or day's work. This bottom cutting or undergoing is carried inwards some 15 or 18 feet, of the width of the gate road 9 feet. One side is then cut up 18 inches thick to the top of the Slipper coal, or next section, in stints of 3 feet vertically and 12 feet inwards, making 36 square feet per day; and this done, the coal is broken down from the fast side by mechanical means, wedge or gunpowder, and removed by the various workmen. The air head is driven at the same time, generally in the Tow coal, the fourth seam from the top; and a communication is made from it to the upcast shaft. The dimensions of the air head are about 4 feet high by 4 feet wide, giving a sectional area of about 16 square feet. It is usual to drive two gate roads, one from each shaft, in the same or in opposite directions, the air heads from each being conducted to the upcast shaft. When the two gate roads are driven in the same direction, and the mine is tolerably free from gas, the ventilation is effected by the gate roads alone, and the use of the air heads is dispensed with. Communications or "spouts" are made at certain intervals between the air head and the gate road, so that a proper supply of fresh air may always be secured close up to the spot at which the workmen are employed, an attention to which is of great importance.

When the gate roads are completed, the next process is to open off the work, and in this operation arrangements are made for getting out as large an area of coal in each panel or "side of work" as is practicable. This is more or less controlled by the nature of the coal, and the quantity of rubbish, technically called "gob," to be left behind in the pits as worthless, which, from its tendency to heat by the decomposition of the iron pyrites contained in it renders the risk of fire more or less imminent. In opening off, the first step in the ordinary "Rib and Pillar" system of working, is to drive two lateral openings about 9 feet wide, called "bolt holes," about 100 feet apart of a length equal to the proposed thickness of the rib intended to be left as a support on each

side of the gate road, usually about 30 feet. The process of undergoing the coal is then commenced, for which lengths of about 30 feet are marked off for working space, leaving alternate intervals of 24 to 30 feet as pillars for the support of the roof; and this marking off is repeated according to the number of pillars it is proposed the "side of work" should contain. The mode of undergoing is the same as that described in driving the gate roads; four or five men working in a row and in a horizontal position, each excavating 6 feet by 6 feet or 36 square feet horizontally, and 18 inches thickness for a "stint" or day's work. A square of 6 feet in the middle of each space of 30 feet thus undergone is then underbuilt, partly with timber packings; on which is left a minor pillar, or "man-of-war" or "cog," which is eventually taken away, but which serves temporarily to support the coal in the opening over the men. The cogs are underbuilt with timber, in order to admit of a slight settling taking place, which renders them less liable to be split or to be thrown out of place by the superincumbent weight. When the undergoing has been carried in 15 or 18 feet, the second process of cutting through the Slipper coal vertically on one side is effected, 12 feet inwards by 3 feet height and 18 inches thickness being cut for a day's work. The coal being set at liberty on the side so cut, is broken off on the other by wedging or blasting, and then removed by subordinate workmen attendant on another class of men called the "bondsmen," whose business it is to load the coal on to the skips or carriages by which it is conveyed on railways to the pit's bottom. The next process is to cut the third section of coal, the Sawyer and Patchels coals, which is effected in a similar manner, and so on to the fourth cutting in the Stone coal. This completes the cutting of the bottom coals, which are then broken down and removed. The upper portions of the bottom coals are reached by raising the floor with the slack and refuse produced in cutting the lowest measures. The cuttings are made around the pillars and cogs.

The fifth cutting begins the top series of coals, and is in the Veins and Fine coals, which are reached by means of a scaffold. Here commences the most hazardous part of the process. The underbuilding of the cogs is then removed, and the cogs themselves come down throughout the entire height of the coals recently cut: the remainder of the coals uncut, being thus deprived of their support in the centre, deflect, or, in the language of the collier, "swag," and occasionally fall down more or less suddenly without further interference. Their tendency to fall is tested by the overman from time to time by tapping them in various places with the pike. When the cogs are removed, the floor of the mine usually "creeps," or is forced upwards by the pressure of the permanent pillars, thus affording greater facilities for reaching the upper coals in the further process of cutting in. If the upper coals have not already fallen, the sixth cutting is made in the Brazils coal, the seventh in the Tow coal, and the eighth in the White coal. During the cutting, the top coal is partially supported by wooden spirns or wedges driven upwards into the cuttings, which are withdrawn as soon as the preparations for falling the coals are completed. The remaining measures, namely, the Spires and Roof coals, are seldom cut, or, if cut at all, only half through, and are eventually forced down by the workman acting upon them with a long pole, armed with a strong pricker.

In cases where the measures immediately above the coal are weak and friable, the top measure of coal is left for a roof. At this stage of the proceedings it is necessary to remove the gob or rubbish, which by this time is beginning to heat; the larger fragments are piled round the permanent pillars, which they serve to support in some degree, and the small is distributed by boys about the floor of the mine. When all the coals, excepting the pillars permanently left, are thus removed from each panel or side of work, and as large an area worked as is consistent with safety, which may vary from four to ten pillars, according to the character of the coal, dams or air-tight stoppings are built in the bolt holes, to prevent fire by cutting of all communication with the external air.

It is in cutting in the top series of coals that the danger to the collier chiefly arises; and it is only to men of experience, vigilance, and activity, that this department should be entrusted,—the coal often coming down before the cutting is completed; usually however giving some previous warning by a peculiar crackling sound, which the men instantly recognise, and hastily quit the scaffold and retreat to some place of safety. In addition to this special source of danger, great risk is further occasioned by the extensive occurrence in the Thick coal of numerous dislocations, called "slips" and "things," with which the whole seam is reticulated, and which form natural partings that the workmen have no previous knowledge of. When these are intersected in cutting the coals, it frequently happens that the coals fall without any warning, and the unfortunate workman is crushed beneath them. The records of the loss of life from this cause place South Staffordshire in a melancholy pre-eminence in comparison with other districts.

During the process of working, the ventilation is effected by carrying on the air heads into the side of work as high in the coal as may be found needful to clear the upper part of the work of any gas that may be given out: the fresh air traversing the gate road and through the bolt hole, and circulating freely round the part of the work where the men are employed, making its exit by the air head into the upcast shaft. Some practical difficulty arises from the occasional tendency of the current of air to stagnate or to reverse itself, to which it is more subject in hot weather, when the temperature of the mine and that of the external air become more equalised. The pits are then said to fight, and this can be remedied only by increasing the temperature of the upcast shaft artificially by a furnace connected with it, to stimulate the draught. At ordinary temperatures of the atmosphere, however, the higher degree of heat in the working places of the mine, usually from 65° to 70°, is itself sufficient to keep the current of air in motion at the rate of about 30 feet per second in the gate roads, and in the air heads at about 120 feet per second; which affords an abundant supply of fresh air for the efficient ventilation of as many sides of work as can be kept open at a time.

Now two cardinal points demand attention and enquiry in reference to this rib and pillar mode of working the thick coal—first, the apparently imperfect mode of ventilation; and, secondly, the inadequate produce of coal per acre, considering the thickness of the seam.

As to the first, imperfect in some respects as the method of ventilation certainly is, it has not hitherto been found practicable to adopt

any plan more effective; and, on the whole, very little complaint has to be made under this mode of thick coal, with the ordinary vigilance which it is incumbent on every manager of a mine to exercise. Other plans have been devised and partially acted upon, but they have not become satisfactorily established. One of these, originally promulgated by Mr. B. Gibbons of Shut End, may be briefly described. In this plan of ventilation, instead of fresh air being supplied to the workings by means of the upcast and downcast shafts in the ordinary mode, each shaft is made to ventilate its own workings by the addition to the shaft of what is called "trumpeting" or smaller supplementry shaft, in connection with which a ventilating furnace and chimney are erected at the surface for the purpose of artificially increasing the natural draught of the pit. It will be seen that this trumpeting is a substitute for the ordinary upcast shaft, and the chief objections to it are, first, its original expense, which, if it is made sufficiently capacious to be effective, is nearly equal to that of a separate upcast shaft; and, secondly, its limited dimensions and consequent liability to derangement. These objections have deterred the practical managers of mines in South Staffordshire from adopting the plan.

In the present state of the thick coal seam, the risk of accident from fire damp is far less than when mining operations first commenced in it. The carburetted hydrogen gas, in which it is so prolific, escapes wherever any incision is made in the coal by which a vertical section of its laminæ is exposed to the air. The great extent to which the thick coal is now cut up in all directions affords such abundant channels of escape for this gas, that the enemy, which was formerly so dangerous to encounter and difficult to subdue, is now, by the aid of the safety-lamp, controlled with comparative ease. Before, however, the ventilation by the present system of high air heads and the use of the safety-lamp were established, devices for dissipating the gas were adopted which would now be considered unjustifiably dangerous. Plot, in his history of Staffordshire, 1686, speaking of the mode of working the mines near Wednesbury, describes the mode of ventilation thus:—"In working the mine much inconvenience is experienced by the presence of damp. One sort is expelled either by water or by letting down an iron cradle, as they call their lamp, filled with fire, into the shaft or the bye pit next to that they intend to work, which, making a draught, draws away the foul air. Another sort is expelled by a person entering the pit before the workmen, covered with wet sackcloth; when he comes near where the damp is feared, he creeps on his belly, with a long pole before him, having a lighted candle upon the top of it, which, coming in contact with the foul air, it explodes and escapes by the mouth of the pit; the person that fired it escaping by creeping on the ground, keeping his face close to it till it is over." Even down to modern times, schemes as daring and hazardous as that described were the common resource in many parts of South Staffordshire. It was not until about the year 1810 that any material improvement was effected, when a mining engineer named John Ryan, an Irishman, made his appearance in that district, and proffered his services to free the fiery mines in the neighbourhood of Netherton from fire-damp, at least to such an extent as to make them comparatively safe to work. Whether he redeemed this pledge to the full extent of his professions

is doubtful; but it is certain that he effected very considerable improvement in the ventilation. His plan was to surround the workings with a separate air head carried up high in the coal, into which all the foul air and inflammable gas were conducted and carried to the upcast shaft; and although it was found that the requisite conditions in the coal for carrying out his plan in its integrity could not be met with in practice, yet modifications of it were adopted, and the present mode of ventilation is unquestionably the offspring of his genius. The courage and perseverance with which Mr. Ryan prosecuted his system were deserving of the highest praise, and the danger which he personally encountered and the resolution which he displayed were such, that he was familiary known among the colliers by the name of "hell-fire Jack." The introduction about the year 1815 of the safety-lamp of Sir H. Davy into mines of a fiery character was an invaluable aid, both as regards the safety of life and the practical facility of working. By its use not only was the presence of the enemy detected, but it admitted of means of being adopted by the workman for dissipating the gas under circumstances that were quite impracticable with a naked light; and it may be safely said, that no greater boon has been conferred on mankind than that which this admirable invention has given to the miner.

Whilst, however, it is the business of the manager of a thick coal mine to adopt measures for ample ventilation, some precautions are necessary against a too abundant supply of fresh air, by which the natural tendency of the gob to fire is greatly increased; and in avoiding Scylla, therefore, care must be taken not to run foul of Charybdis. This is one of the difficulties of the miner's craft, and one with which the earliest miners had to contend. It is the duty of a prudent miner to leave as little refuse, forming the gob, as possible in each side of work; and if it fire, to have the work sufficiently at command to be able immediately to exclude the fresh air by the erection of dams in the bolt-holes or entrances to the side of work, and thus extinguish the fire by depriving it of air.

The second point demanding attention,—the insufficient produce of Thick coal per acre,—has long been a source of perplexity to the enquirer. A seam of Thick coal 10 yards thick contains 48,400 cubic yards per acre, each cubic yard weighing 1 ton of 2,240 lbs., making 48,400 tons per acre; and deducting one-fifth for partings and spoil, 38,720 tons of clear coal are left as the produce of one acre. But the first working by the rib and pillar system already described does not usually produce more than about 15,000 to 16,000 tons per acre; rarely more, frequently less. This produce, however, represents the usual nominal selling tons by boats and otherwise, prescribed by leases and the custom of the trade, of which it is difficult to define the exact weight; also the coal allowed to colliers and the small coal consumed at the steam engine, of which no account is taken, have to be added: and these together will bring up the actual produce to probably little short of 19,000 or 20,000 statute tons per acre. To this has to be added the produce of the after working of the ribs and pillars, which is a much more expensive and yet distant process; which will bring the total produce probably to 23,000 statute tons per acre, a quantity, however, much less than that produced by the other mode of working called the "long wall" system.

In the long wall system of working, the thick coal seam is divided into two workings, of such a thickness each as will admit of the whole of the coal in each division being cleared out, instead of leaving ribs and pillars as by the rib and pillar system previously described; the top portion being worked first. The driving out of the gate roads is effected as in the rib and pillar system, and one or more main gate roads are carried forward from the shaft to the outside of the portion of coal proposed to be worked, usually in the Brazils measure, about 16 feet from the top of the seam. On arriving at the outside boundary, lateral openings are made right and left of the road, and driven along sufficiently far until space is gained for the commencement of a regular face of work. The holeing or undergoing is then begun, and the coal cut and broken down progressively, the colliers working back towards the shaft, and "leaving," as they describe it, "all their troubles behind them." At the outset of the operation, it is necessary to cut the coal vertically, in the manner previously described in the rib and pillar system; but the "shut," or the part of the roof left behind, soon begins to break down, and the coal over the holeing comes down of its own accord: by leaving cogs behind them, the workmen protect themselves against any premature fall of the roof, until it can be allowed to come down without danger. "In this manner," says Mr. Brough, "they keep sweeping fine sides of work homewards, just as the mowers sweep away swathes of grass in a hay field. The rock or shut follows them, and with it they build the most useful fortifications in the world. Thus, with a face of coal in front, so spragged (underbuilt) that all danger is out of the question, and a building behind them as strong as a castle, it would be surprising indeed if the workmen got the slighest hurt, much more lost their lives." When the whole upper portion of the coal has been thus abstracted, the bottom portion is worked in the same manner; a few feet of coal being left in the middle of the seam to serve as a roof for the lower working.

It must be admitted that, in point of safety to the men, as well as in the larger produce of coal per acre, the long wall has a manifest advantage over the rib and pillar system. The ventilation is perfect, the current being kept in a continual stream along the working face, with very little liability to disturbance; and the produce of coal, on a moderate estimate, is from 5000 to 7000 tons per acre more than in the rib and pillar system. On the comparative advantages of these two modes of working the thick coal, a great deal has been said and written, both by coal owners, professional viewers, and mine inspectors; but many of the special circumstances that determine either mode in any particular instance have either been ignored or overlooked. It is beyond question, that by the rib and pillar system a certain loss of coal is involved compared with the long wall system; but it must be borne in mind that the value of the thick coal depends mainly on the size in which it can be sent into the market, the selling price gradually decreasing with the bulk, so as to afford a range of from, say, 10*s*. to 2*s*. per ton in coal of the same quality; a distinction quite unknown in the bituminous coal of the North of England. Now if a much greater proportion of large coal at the higher selling prices, and less of the small coal or slack at the lower selling prices, can be obtained by the rib and pillar system, it may happen, and in fact does frequently

happen, that the pecuniary value of the smaller product per acre may exceed that of the larger; and inasmuch as the royalty is usually based on the selling price per ton, it is the proprietor's interest to have that mode of mining adopted which will yield him the largest return per acre. Hence, in most of the leases under which the thick coal is worked, there is an express stipulation that the system of mining shall be restricted to the ordinary rib and pillar mode of working. It is true that, owing to the increased demand of the ironworks for the rough slack used at the puddling and blast furnaces, the price of this description of coal has approximated of late much more closely to that of the large coal than was formerly the case, and greater latitude is consequently allowed for the adoption of any improved mode of working. But it must be borne in mind, that many conditions are requisite to admit of the long wall system being adopted; such as an ample extent of mining ground, absence of faults, facility for consumption of the coal in all shapes, and freedom from legal restrictions; a combination of advantages rarely attainable. It is but justice, therefore, to the character of South Staffordshire to say that, in some of the larger undertakings in the western portion of the districts where these conditions are met with, improved modes of working have been long in use.

IV. As regards the area of thick coal remaining unworked, and its probable duration at the present rate of working, there is, of course, considerable difficulty in obtaining sufficient data to admit of accurate calculation. All that can be done is to ascertain from the most authentic sources the area unworked in each portion of the district, the weekly or annual quantity of coal got, and the number of tons each acre is considered to yield; this will give the total number of tons remaining in each portion, and hence the period of duration.

In the eastern portion of the district, the extent of thick coal remaining unworked may be estimated at about 1160 acres, yielding in the first and second workings about 20,000 tons per acre, making a total of 23,200,000 tons. The present rate of working is about 11,000 tons per week, which, for 50 working weeks, amounts to 550,000 tons per annum. The probable period of duration is therefore about 42 years.

There is more difficulty in framing an estimate for the western portion of the district, owing, firstly, to the larger area unworked; and, secondly, to the absence of proof of the actual extent of the thick coal in a southerly direction; the estimate is therefore confined to the limits previously mentioned, as proved in that direction, namely, from Stourbridge to Halesowen. With this limitation, the area unworked is estimated at about 2785 acres, which, at 20,000 tons per acre, gives 55,700,000 tons. The present rate of working is about 30,000 tons per week, or 1,500,000 tons per annum. The probable period of duration is therefore about 37 years.

It will be obvious that the respective periods of duration here given will be materially modified by the greater or less rapidity with which the present workings are carried on, and still more by the extent of the area under which the coal may eventually be found to extend in the unproved portion of the district southwards. It is certainly reasonable to infer, on every geological presumption, that a large extent of thick coal may yet be available for future working, which is altogether

excluded from this estimate. It may however be assumed, that at the expiration of another half century, this noble seam of coal, the pride and glory of South Staffordshire, will exist only in name; and the future importance of this busy hive of industry must be sought in other resources than that which was hitherto contributed so largely to its strength and prosperity.

THE LITERARY AND PHILOSOPHICAL SOCIETY.

October 2nd, 1860.

DR. JOULE, PRESIDENT, IN THE CHAIR.

At this, the first meeting of the Session, the President brought under the notice of the Society a sheet of copper, upon which, whilst under magnetic influence, iron had been deposited electrolytically. The experiment was made by Mr. F. H. Hobler, of London, as follows:—The plate of copper, forming the bottom of a shallow vessel, filled with a saturated solution of sulphate of iron, was placed on the poles of a horse-shoe magnet, fixed vertically with its poles uppermost. An iron wire, dipping into the solution, was placed in connection with the positive electrode of a Daniell's cell, of one pint capacity, the copper plate being connected with the negative electrode. The deposited iron exhibited the lines of magnetic force in the same manner as in the case of iron filings scattered on a sheet of paper placed over a magnet. When Mr. Hobler substituted a plate of tinned iron for the copper, he observed indications, though very faint ones, of the same phenomenon. On using a saturated solution of sulphate of copper, Mr. Hobler observed that the deposit was even throughout, and that no specific position of the axes of the crystals of copper could be detected, although they invariably formed on the outside of the two poles. Mr. Hobler, in discussing the phenomenon, enquires whether it is produced by the action of the magnet upon the solution in direction of the lines of force, or whether the iron is formed in the solution immediately above the copper plate, and then attracted by the magnet into the direction of the lines of force. The former suggestion appears to him to be inconsistent with our present knowledge of the influence of magnetism on chemical action; the latter with the theory of electro deposition, which supposes the coating to be formed on the plate and not *deposited*, strictly speaking, thereon.

The President exhibited a paper which he had received from Professor Thomson. On the paper was printed, by photography, the line indicating the various changes of atmospheric electricity, which took place at the Observatory at Kew during twelve successive hours. Much interest was excited by witnessing one of the first fruits of Professor Thomson's beautiful instrument. The paper indicated a series of very rapid oscillations, about one per minute, of the intensity of atmospheric electrical force.

Mr. Henry Bowman presented the following statement of observations on the temperature of the six summer months, ending September

30th, 1860, taken by a self-registering thermometer at Victoria Park, Manchester:—

1860.	Maximum.	Minimum.	Range.	Mean.	Mean of 47 years, 1794 to 1840, inclusive. (1)	Mean of 1860 above that of same period.	Mean of 1860 below that of same period.	Number of corresponding months in same period, with means as low as in 1860.
April	64°·4	27°·7	36°·7	43°·6	47°·1	°...	3°·5	6
May	77·2	31·3	45·9	54·0	53·2	0·8	...	29
June	72·4	39·6	32·8	55·8	58·2	...	2·4	10
July	78·0	40·2	37·8	58·5	60·8	...	2·3	12
August	71·2	42·0	29·2	56·0	60·4	...	4·4	1 (2)
September	66·2	31·5	34·7	51·9	56·3	...	4·4	2 (3)
The six months together	78·0	27·7	50·3	53·3	56·0	...	2·7	...
Twelve months ending Sept. 30, 1860.	78·0	9·5	68·5	46·4	48·8	...	2·4	4 (4)

The maximum temperature in the 12 months was 78° on July 9th.

The minimum temperature in the 12 months was 9·5° on December 19th.

(1) From Tables by Dr. Dalton, Society's Memoirs, Vol. III. (new series), p. 494, and Vol VI., p. 572.

(2) The mean of August, 1799, was 55°·0.

(3) The mean of September, 1803, was 51°·7; 1807, 50°·1.

(4) The mean of the year 1795 was 46°·4; of 1799, 44°·6; of 1814, 45°·4; and of 1815, 46°·2.

Mr. Atkinson stated that, during the months of June and August, he had observed the extraordinary rain-fall of 13 inches at Thelwell. The fall in July was not considerable.

Mr. Dyer having stated that on the morning of August 11th, a very loud explosion was heard in the neighbourhood of Blackfriars, London, the sky being clear at the time, a conversation took place on the subject of fire-balls and meteorites, in the course of which Mr. Ekman stated that during a most violent thunderstorm, passing over a tract of land intersected by a rapid stream, he had distinctly seen fire-balls, the diameter of which he estimated at 2 ft., projected from the clouds down into the water. The distance of the point where he stood, from the point at which the balls struck the water, could not have been more than 150 to 200 yards. The phenomenon was witnessed in Sweden many years ago.

Mr. Wild exhibited the universal or alphabet telegraph of Professor Wheatstone, and pointed out the successive improvements which had resulted in this admirable invention.

October 16th, 1860.

DR. R. ANGUS SMITH, VICE-PRESIDENT, IN THE CHAIR.

The Chairman gave a short account of his examination of coal pyrites for arsenic. He stated that although the knowledge of the existence of arsenic in the iron pyrites found in coal may not be considered perfectly novel, it certainly does not seem to be known that arsenic is so widely disseminated as to form an ordinary constituent of the coals burnt in our towns, and chemists of celebrity have held it, and now hold it, to be absent there. He had examined fifteen specimens of coals in Lancashire, and found arsenic in thirteen. He had also found it in a few others, but Mr. Binney, having promised a collection, properly arranged, the examination will be more complete. Mr. Dugald Campbell had also lately found arsenic in coal pyrites. The Chairman added that this had a very direct bearing on our sanitary knowledge, as we must now be obliged to add arsenic to the number of impurities in the atmosphere of our large towns. It is true that he had not actually obtained it from the atmosphere, but when the pyrites is burnt the arsenic burns, and is carried off along with the sulphur. One or two coal brasses (as they are called) contained copper, a metal that is also to some extent volatilized, as may be readily observed wherever copper soldering takes place. Although an extremely small amount of copper is carried up from furnaces, it is not well entirely to ignore it. The amount of arsenic, however, is probably not without considerable influence, and we may probably learn the reason why some towns seem less affected than others by the burning of coals, by examining the amount of arsenic burnt as well as sulphur.

Mr. Spence said that he could confirm the remarks concerning the existence of arsenic in coals, as he had burnt coal and pyrites for many years, and had always found a very decided amount of arsenic in the sulphuric acid made from it.

Mr. Ransome called attention to the peculiar symptoms described by Berzelius, as produced by selenium, and he considered that some similar symptoms were produced in a manner which might be explained if selenium were found in coals.

PROVISIONAL PROTECTIONS GRANTED.

1860.

[*Cases in which a Full Specification has been deposited.*]

2413. Theodore Mansfield Richardson, of the State of Maine, U.S.A., for a new and useful or improved steering apparatus for navigable vessels.—[*Dated October 5th.*]

2444. William Snell, of Clement's-inn, Strand, for an improved machine for making horse-shoe nails,—being a communication.—[*Dated October 9th.*]

2480. Louis Henri Rousseau, of Paris, for certain improvements in steam-engines. — [*Dated October 11th.*]

[*Cases in which a Provisional Specification has been deposited.*]

1394. William McIntyre Cranston, of King William-street, London-bridge, for improvements in reaping machines,—being partly a communication.—[*Dated June 6th.*]

1559. Margaret Jarrett Laurie Latta, of Ashton-Gourock, Renfrewshire, N.B., for improvements in the treatment of various substances, for the purpose of rendering the same non-inflammable. [*Dated June 27th.*]

1818. Carl Schön, of Minden, Prussia, for improvements in the construction of propelling wheels for ships.—[*Dated July 27th.*]

1854. Adam Dixon, of Birmingham, for improvements in knife-cleaning machines.—*Dated July 31st.*]

1864. John Ryde, of Queen-street, Cheapside, for an improvement in apparatus applicable to turn-tables, swing bridges, cranes, and other machinery acting on a pivot,—being a communication.—[*Dated August 2nd.*]

2022. François Remy Grumel, of Paris, for improvements in the albums of collection of photographic and lithographic proofs, engravings, and other drawings.—[*Dated August 22nd.*]

2024. Joseph Corbett and Robert Smith, both of Hornsey New Town, Stoke Newington, for an improved portable circular crane; applicable also as a fire-escape.

2026. Richard John Cole, of Chepstow-villas West, Bayswater, for improvements in the construction of brushes.

2028. Samuel Purchas, of Worcester, for certain improvements in the application of brakes to railway carriages,—being a communication.

The above bear date August 23rd.

2035. William Edward Gedge, of Wellington-street, for improvements in turbinical hydraulic apparatus,—being a communication.

2042. James Fleming, jun., of Newlands-fields, Renfrewshire, N.B., for improvements in washing, cleansing, and preparing textile fabrics and materials, and in the machinery or apparatus employed therein.

The above bear date August 24th.

2057. Marc Antoine François Mennons, of Paris, for improvements in the construction of axle boxes and axle bearings,—being a communication.

2068. John Bingley, of Leeds, for improvements in hydraulic presses, parts of which are also applicable to other purposes.

The above bear date August 27th.

2083. Charles Iliffe, of Birmingham, for improvements in the manufacture of metallic and non-metallic substances for expanding dresses and other purposes.

2086. Edward Deane, of Arthur-street East, London Bridge, for improvements in apparatus for facilitating culinary roasting.

The above bear date August 29th.

2091. William Kirrage and Abraham Ripley, both of Albion-place, Vauxhall, for the amalgamation of certain materials forming a plastic composition, applicable to works of the fine arts, building purposes, imitations of marbles, ancient carvings, and various other uses.

2096. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the manufacture of railway chairs, —being a communication.

The above bear date August 30th

2102. George Richardson, of Levenshulme, near Manchester, for an improved instrument to be used for ascertaining distances.—[*Dated August 31st.*]

2112. Frederick Allen, of Seymour-place, Bryanstone-square, for improvements in a machine called a dumb jockey, used for the breaking and training of horses.

2114. Ward Holroyd and Samuel Smith, both of Halifax, for improvements in looms for weaving.

2115. John Cobb Bowler, of Bowden, near Manchester, for improvements in obtaining motive power.

2116. Charles Weightman Harrison, of Plumstead-common, for improvements in electric telegraphs.

2118. Stephen Hargreaves, Robert Holden, and James Nuttall, all of Haslingden, Lancashire, for an improved warping machine.

2120. George Hollands, of Rochester, for improved apparatus to be used in the process of fermentation.

The above bear date September 1st.

2122. James Edward Boyd, of Hither Green, Lewisham, for improvements in machines used for cutting, scattering, and collecting vegetable and other substances.

2124. Henry Moore and Samuel Newberry, both of Burnley, for improvements in machinery for sizeing or dressing warps or yarns.

2126. George Edmond Donisthorpe, of Leeds, for improvements in sizing yarn or thread previous to warping.

2127. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the manufacture of moulds and cores for the casting of cylindrical articles, and in the machinery or apparatus employed therein,—being a communication.

2128. Thomas Grimston, of Clifford, Yorkshire, for improvements in machinery for balling threads, yarns, or twines, made from fibrous materials.

The above bear date September 3rd.

2129. William Henry Delamare, of Clarence-place, Hackney-road, for an improved machine for cleansing and peeling grain and seeds.

2130. James John Stevens, of Darlington Works, Southwark, for improvements in iron bedsteads,—being a communication.

2131. John Hughes, William Williams, and George Leyshon, all of Brierly Hill, Staffordshire, for improvements in the manufacture of tin and terne plates, and in apparatus employed therein.

2132. Henry John Standly, of Pall-Mall East, for improvements in the production of gas, for illumination and other purposes, and the utilization of the products arising therefrom.

2133. George Printy Wheeler, of Abinghall, near Mitcheldean, Gloucestershire, for an improved mode of, and apparatus for, preparing half-stuff for paper makers.

2134. George Printy Wheeler, of Abinghall, near Micheldean, Gloucestershire, for an improved mode of, and apparatus for, preparing bleaching agents.

2135. Anthony Southby, of Bulford, Wilts, for improvements in the manufacture of paper.

The above bear date September 4th.

2136. Harold Potter and Alfred Peck, both of Manchester, for improvements in treating or preparing textile materials and fabrics.

2137. Sigismund Schuhman, of Burnley, for improvements in looms and in the means of driving the same.

2138. David Yoolow Stewart, of Glasgow, for improvements in moulds for casting.

2139. Ernest Vauvillé, of Paris, for a system of extracting juice from beetroot and other plants.

2140. William Edward Gedge, of Wellington-street, for improved cylinders for laminating metals,—being a communication.

2141. John Cooper, of Bilston, for improvements in railways, railway carriages, and apparatus connected therewith.

2142. Frederick Ransome, of Ipswich, for improvements in preserving stone, bricks, and other porous building materials, and in cementing porous and others matters in manufacturing blocks and other articles thereof.

2143. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improvement in belt shippers, —being a communication.

2144. George Bedson, of Manchester, for improvements in annealing, cleaning, and galvanizing, or otherwise coating wire and sheets or strips of metal with metals.

2145. Maurice Vergnes, of New York, U.S.A., for an improvement in the construction of magnetic or electric helices.

2146. George Fergusson Wilson, of Belmont, Vauxhall, and John Jackson, of Bromborough Pool, near Birkenhead, for improvements in lamps and lamp wicks.

2147. Walter Robert Kinipple, of Limehouse, for an improvement in water-closets, and in flushing tanks or apparatuses.

2148. John Huggett, of Eastbourne, Sussex, for a method of, and apparatus for, regulating the light in street and other lamps, whereby the re-

lighting and extinguishing of the same may be dispensed with.

The above bear date September 5th.

2149. Josephus Walker, of Bradford, Yorkshire, for improvements in self-acting temples.

2151. John Davies, of Manchester, for an improved application of material to the manufacture of coupling apparatus to be employed in connecting locomotive engines, tenders, and carriages, together upon railways.

2152. William Henry Burke, the elder, and William Henry Burke, the younger, both of Brompton, for a method of preparing fabrics composed of or containing caoutchouc, to enable them to resist the action of colors and varnishes containing oil.

2153. Richard Wright, of Grosvenor-street, Camberwell, for improvements in the manufacture and refining of sugar, and in apparatus employed therein.

2154. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the manufacture of archil,—being a communication.

2155. Benjamin Oldfield, of Coventry, for improvements in looms.

2156. Aaron Lester, of Coventry, for an improvement in looms for weaving.

2157. George Herring, of Albert-terrace, Hatcham-park, and David Lichtenstadt, of Peckham, for improvements in treating a certain substance to obtain textile fibres and materials for paper making, and charcoal for gunpowder, pyrotechnic, and other purposes.

The above bear date September 6th.

2158. Benjamin Nicoll, of Regent-street, for an improved method of treating needles, and needles used in sewing and other machines; applicable also to those parts of such machines that hold the needles.

2159. Augustus Dacre Lacy, of Knayton, Yorkshire, aud William Collett Homersham, of Adelphi-terrace, for improvements in machinery and implements for ploughing and cultivating land.

2160. Joseph Siddall Travis, of Stretford, near Manchester, for improvements in traction engines.

2161. Charles Stevens, of Welbeck-street, for an improved method of preserving various alimentary substances,—being a communication.

2162. Charles Stevens, of Welbeck-street, Cavendish-square, for an improved impermeable oil varnish,—being a communication,

2163. Charles Stevens, of Welbeck-street, for improved bags to be used in the manufacture of sugar,—being a communication.

2165. Charles Cowper, of Southampton-buildings, for improvements in the manufacture of cast steel, and in the re-manufacture of old steel,—being a communication.

2166. John Hamilton, Jun., of Liverpool, for improvements in sockets for receiving the lower parts of the posts or uprights employed in constructing electric telegraphs.

2167. Paul Elias Aubertin, of Great Winchester-street, for improvements in the manufacture of soap,—being a communication.

2168. James Henry Staples Wildsmith, of Wolverhampton, for a new or improved lubricating material or compound, which said material or compound may also be employed in the manufacture of soap.

2169. James Spratt, of Camden-road-villas, Camden-town, for improvements in electrical conductors and their fittings.

2170. Edward Deane, of Arthur-street East, London Bridge, for an improved rotary cooking apparatus.

The above bear date September 7th.

2171. Elias Weiskopf, of Pesth, for improvements in the manufacture of certain kinds of artificial combustible for lighting of wood and coal.

2172. Deane John Hoare, of Albemarle-street, Piccadilly, for improvements in locks.

2173. Peter Richards Cross, of Sudbury, for improvements in means or apparatus to give protection to the mouth and nostrils in respiration, and to the throat and chest against the injurious effects of atmospheric influences.

2174. Frederick Yates, of Parliament-street, for improvements in apparatus for, and in the mode of, manufacturing iron, steel, and other metals and substances, gaseous and solid; fuel

being thereto applied as the heating, reducing, cementing, and oxydizing agents.

2175. Enoch Horton, of Darlaston, Staffordshire, for new or improved machinery to be used in the manufacture of bolts, nuts, and screws.

2176. Armand Louis André Herbelot, of Paris, for an improved method of mauufacturing paper from wood.

2177. William Edward Gedge, of Wellington-street, for improved means of extinguishing conflagrations,—being a communication.

2178. Jean Baptiste Frédéric Duvergé, of Bordeaux, for improved machinery or apparatus for horizontal, vertical, or inclined boring.

2179. Joseph Fourdrinier, of Grove-terrace, New Peckham, for improvements in kilns for drying grain, seeds, and other agricultural produce.

2180. James Wood, of West Smithfield, for improvements in stereotyping apparatus.

2181. John Joseph Conrad Kleinfelder, of Paris, and Charles Girardet, of Vienna, for improvements in carriages and harness for horses, and in the means of attaching harness to carriages.

2182. Geminiano Zanni, of Upper King-street, Holborn, for improvements in apparatus for roasting.

The above bear date September 8th.

2183. François Jean Cantagrel, of Paris, for apparatus for ascertaining the existence of escapes in pipes and vessels for conveying and holding, lighting, and heating gases; which apparatus he denominates "escape indicator."

2184. Thomas Thornton, Edwin Thornton, and Joseph Thornton, all of Elland, Yorkshire, for improvements in looms for weaving.

2185. William Evans Robson, of Adam's-court, Old Broad-street, for the application of an improved elastic material for springs or cushions on the chairs of railways and tram-roads, or in any other position, to prevent the friction caused by the working of iron on iron or other metal substances.

2186. William Wilkinson and Henry Thompson Wright, both of Boston, Lincolnshire, for improvements in apparatus used when stacking straw and other agricultural produce.

2187. Thomas Turpie, of North Shields, for improvements in furling sails.

The above bear date September 10th.

2188. Henry Cheetham Hill, of Stalybridge, for improvements in the construction of stays for steam-boilers.

2189. James Greenwood, of Halifax, for improvements in looms for weaving.

2190. George Wellman, of Lowell, U.S.A., for improvements in carding engines, for carding cotton and other fibrous materials.

2191. Donald Nicoll, of Regent-street, for an improved over coat, particularly adapted to military purposes; to be called "Nicoll's Lucerna."

2192. Marc Antoine François Mennons, of Paris, for an improved apparatus for sealing letters and other documents,—being a communication.

2193. Robert Calvert Clapham, of Walker, Northumberland, for improvements in the manufacture of bleaching powder, and apparatus employed therein.

2194. Jean Dénéchaud and Joseph Chapa, of Bordeaux, for an electric controller for indicating the relative position of trains on railways.

2195. David Peacock, of Walpole-street, New-cross, and Thomas Richard Truman, of Edwin-place, Peckham, for improvements in the construction of wheels for traction and locomotive engines.

2196. Thomas Boyle, of Belfast, for improvements in preparing machinery for flax and other fibrous substances.

2197. Ebenezer Clemo, of Toronto, for an improved mode of manufacturing stock for paper from straw, and other vegetable substances.

2198. Gilbert Lucien Pierre Coopman, of Constantine, Algeria, for new means and processes of tanning hides and skins, by which a graduated impermeability of leathers is obtained.

The above bear date September 11th.

2200. Benjamin Baillie, of Henry-street, Cumberland Market, for an improved rifle-range.

2201. William Massey, of Linacre Marsh, near Liverpool, for improvements in the manufacture of artificial mineral teeth, and the means where-

by the same may be more securely attached to artificial gums and palates, formed of vulcanite or other similar materials.

2202. Frederic Antoine Nicolas Freppel, of Paris, for an improved preservative and sizing compound for sizing cotton, wool, linen, or other yarns, for weaving and for dressing textile fabrics.

2203. Robert Henry Capel Wilson, of Wilson-street, Gray's-inn-road, for improvements in registering thermometers.

2204. John Petrie, jun., of Rochdale, for improvements in cocks or taps for liquids.

2205. Robert Hodgson Gratrix, of Salford, and Mathias Paraf Javal, of Thann, France, for improvements in dyeing and printing textile materials and fabrics.

The above bear date September 12th.

2207. James Wright, of Bridge-street, Blackfriars, for improvements in the construction of safety or Davy lamps,—being a communication.

2208. James Wright, of Bridge-street, Blackfriars, for an improvement or improvements in the construction of boots and shoes,—being a communication.

2209. Nathan Thompson, jun., of Abbey-gardens, St. John's-wood, for improvements in boat building, and in apparatus used therein.

2210. Arthur Ransford, of Manchester, for improvements in galleries or supports for gas shades.

2211. George Price, of Wolverhampton, for an improvement in the manufacture of wrought-iron drill-proof safes.

2212. Joseph Chesterton, of Leicester, for a new or improved method of constructing portable buildings.

2213. Edward Field, of Carlisle-street, Soho-square, for a covering for the moustache or hairy parts of the face.

2214. Frederick Michael Murton and Jonathan Millington, both of Strood, for improvements in throttle and expansion valves for engines worked by steam or other vapour, or by liquids or gases.

2215. Wallace Cochrane Somerville, of Upper Albany-street, Regent's-park, for improvements in apparatus for supplying locomotive tenders with water.

2216. George Davies, of Serle-street, Lincoln's-inn, for improvements in the processes of cementation or case hardening and softening iron,—being a communication.

2217. Nicolas Rosinsky, of St. Petersburgh, for a new kind of oil for cosmetics, soaps, and other like articles for the toilet.

The above bear date September 13th.

2218. Francis Alton Calvert, of Manchester, for improvements in steam-engines and boilers, and in valves for steam and other fluids.

2219. Ferdinand Scheithauer, of Vienna, for an improved machine for printing calico and other fabrics.

2221. James Cooke, of Manchester, for improvements in singeing, treating, or finishing textile fabrics, yarns, felts, and other similar materials.

2222. John Burrell, of Norwich, for improvements in the manufacture of woven materials applicable as crinoline and other articles of ladies' dress.

2223. Adam Burdess, of Coventry, for improvements in railway brakes.

2224. John Henry Johnson, of Lincoln's-inn-fields, for improvements in apparatus for raising or lowering and weighing heavy bodies,—being a communication.

2225. James Petrie, of Rochdale, for improvements in steam-boilers.

2226. Luke Turner, of Leicester, for improvements in the manufacture of elastic fabrics.

2227. Thomas Till, of Birmingham, for certain improvements in machinery for making nails; applicable in particular to the making of that description of nails called 'horse nails.'

2229. Pierre André Reddat, of Lyons, for a new propeller.

2230. Joseph Pierre Düsterwald, of Ixelles, near Brussels, for an improved forcing pump for raising beer and other liquids.

2231. William Edward Gedge, of Wellington-street, for apparatus for goffering felt or cloth hats or other analogous articles,—being a communication.

2232. William Edward Gedge, of Wellington-street, for improvements in ornamenting glass with colored de-

signs or pictures in imitation of stained or painted glass,—being a communication.

2233. Robert Mushet, of Coleford, Gloucestershire, for an improvement or improvements in the manufacture of cast steel.

2234. Nathaniel Richard Hall, of Northfleet, for improved apparatus for winding up clocks or timekeepers.

2235. Michael Henry, of Fleet-street, for the employment of a certain sorting process for silk and other fibrous materials, and an apparatus for the purpose of performing the same,—being a communication.

The above bear date September 14th.

2236. William Schnell, of the Strand, for improvements in the manufacture of lucifer matches.

2237. David Davies, and James Allen, both of Manchester, for improvements in apparatus for preventing the explosion of steam-boilers.

2238. Alfred Tronchon, of Paris, for improvements in constructing iron and cast-iron dwelling-houses.

2239. George James Wainwright and Charles Timothy Bradbury, of Dukinfield, for improvements in the manufacture of damasks and similar fancy goods.

2240. Michael Burke, of Gilbert-street, Liverpool, for an improved spring sacking or foundation for a bed, mattress, or other like article, especially adapted for ships' use, barracks, hospitals, and military camps, applicable also for domestic dwellings.

2241. George Davies, of Serle-street, for improvements in lamps for burning coal oil and other like combustible fluids, part of which improvements is applicable to gas fittings,—being a communication.

2242. George Francis Bradbury, of Oldham, Lancashire, and Joseph Jackson King, of Glasgow, N.B., for improvements in binding and folding guides in sewing machines.

2243. James Horsey, of Belvedere-road, Surrey, for improvements in india-rubber teats.

2244. Frederic Seiler, of Paris, for improvements in compressing air or other gas, which may be transferred by tubes for raising water, and for various other purposes.

2245. William Rumbold, of St. Louis, Missouri, U.S.A., for an improved mode of constructing domes.

2246. William Edward Gedge, of Wellington-street, for improvements in the manufacture of manure,—being a communication.

2247. James Murdoch Napier, of York-road, Lambeth, for improvements in machinery for the manufacture of sugar.

2248. Thomas Barnett, of Oldham, Lancashire, for improvements in high-pressure steam-engines.

2249. Stephen Barnwell and Alexander Rollason, both of Coventry, for improvements in combining and mixing certain solutions of pyroxylene with animal, mineral, and vegetable substances, by which its quality is altered in such manner as to produce hard, resistent, adhesive, plastic, or resilient compounds, and articles unalterable in their nature and varied in colour; which said compounds, in a state of solution, may also be advantageously employed as paints or varnish.

2250. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in safety-locks,—being a communication.

2251. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improvement in the construction of brooms,—being a communication.

The above bear date September 15th.

2252. Charles Stevens, of Welbeck-street, Cavendish-square, for a new medico-chirurgical bleeding instrument,—being a communication.

2253. James Hansor, of Portland-place, Wandsworth-road, for improvements in the manufacture of coal gas.

2254. Joseph Edward Betts, of Northampton, for an improved machine for cutting out clothing.

2255. John Henry Walsh, of Kensington, for improvements in breech-loading firearms.

2256. Francis Zysel, of Great Pearl-street, Shoreditch, for improvements in the construction of studs or fastenings for shirt fronts and other articles of dress.

2258. William Hensman Teulon, of Cooper's-row, Tower-hill, for improvements in brewing, and in appa-

ratus employed therein,—being a communication.

2259. John Hay, of Salford, near Manchester, for improvements in machinery or apparatus for making gas burners.

2260. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in lanterns,—being a communication.

2261. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the manufacture of files,—being a communication.

2262. George Grout, of Wood-green, Tottenham, for improved machinery for manufacturing elastic cord.

2263. Robert Crawford, of Beith, Ayr, N.B., for improvements in machinery or apparatus for weaving figured or plain fabrics.

The above bear date September 17*th.*

2264. Horatio Stead, and Henry Gledhill, both of Halifax, Yorkshire, for improvements in finishing textile fabrics, and in the means or apparatus employed therein.

2265. Charles Golden, of Bradford, Yorkshire, for improvements in breech-loading fire-arms and in projectiles.

2266. Edward Joseph Hughes, of Chancery-lane, for improvements in brewing malt liquors; and in apparatus employed therein,—being a communication.

2267. John Strathearn, of Glasgow, for improvements in preparing cotton and other fibrous materials for spinning.

2268. William Cullis, of High-street, Homerton, for improvements in stoppering or closing bottles, jars, and other like vessels.

2269. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in gas meters,—being a communication.

2270. Daniel Miller, of Glasgow, N.B., for improvements in the mode of constructing break-waters, piers, quays, sea walls, and the submarine works of fortifications.

2271. Griffith Owen, of Boston-lodge, Merionethshire, for improvements in the construction of sawing machines.

2272. Rees Reece, of Llandilo, Carmarthenshire, for improvements in treating lignite and certain bituminous mineral substances, so as to obtain products therefrom.

2273. Richard John Cole, of Pembridge-gardens, Bayswater, for ornamenting the external walls of houses and buildings.

The above bear date September 18*th.*

2274. William Holgate, of Burnley, Lancashire, for an improved beaming frame.

2275. Edmund Hunt, of Glasgow, for improved apparatus for preparing saws,—being a communication.

2276. Francis Alton Calvert, of Manchester, for improvements in machinery and apparatus for opening, burring, cleaning, and carding cotton and other fibrous materials, part of which is applicable to opening twisted yarns and woven fabrics.

2277. Richard John Cole, of Pembridge-gardens, Bayswater, for improvements in the manufacture of brushes.

2278. Robert Crawford, of Beith, Ayrshire, N.B., for improvements in apparatus for conveying communications from one place to another.

2279. Emile Martin, of Lille, and Theodore Gudin, of Paris, for improvements in apparatus for manufacturing gas when dissolving zinc or iron in dilute sulphuric or other acid.

2280. Maurice Sautter, of Boulevart Montmartre, Paris, for improvements in generating and applying steam as a motive power, and in apparatus employed for these purposes,—being a communication.

2281. Friedrich Wilhelm Julius Zorn, of London-wall, for improved apparatus for charging and closing the ends of cartridges,—being a communication.

2282. Thomas Greenwood, of Leeds, Yorkshire, for an improved mode of and apparatus for manufacturing files.

2283. Maximilian Simon, of Little Moorfields, for an improvement in sewing machines.

The above bear date September 19*th.*

2285. Alexander William Williamson, of University College, and Loftus Perkins, of Francis-street, Gray's-inn-road, for improvements in surface condensers.

2286. John Oldham, of Derby, for an improvement in machinery for pulping turnips and other roots.

2287. Thomas Briggs, of Salford, Lancashire, for certain improvements in the manufacture of oil-cloth or oil-paper, to be employed for packing purposes, or for coating or covering surfaces, and in apparatus connected therewith.

2288. Robert Kunstmann, of Manchester, for an improved apparatus for lubricating the frictional surfaces of machinery,—being a communication.

2289. John Henry Taylor, of Lee Terrace, Blackheath, for improved apparatus for lowering ships' boats, and disengaging same from the tackles.

2291. Richard Archibald Brooman, of Fleet-street, for improvements in machinery for printing shawls and other fabrics,—being a communication.

2292. John Cash and Joseph Cash the younger, both of Coventry, for an improvement in the manufacture of frillings to be applied to wearing apparel.

2293. George Arnold, and George Arnold, jun., both of Penton-place, Kennington, for improvements in elastic skirts for distending ladies' dresses.

2294. James Cocker, of Liverpool, for an improved construction of packing case.

2295. Theophilus Westhorp, of Manor House, Poplar, for improvements in the manufacture of oakum.

2296. Thomas Richardson, of Newcastle-upon-Tyne, and Manning Prentice, of Stowmarket, Suffolk, for improvements in treating phosphoric matters, and in obtaining products therefrom.

2298. Robert Mushet, of Coleford, Gloucestershire, for the manufacture of a new or improved metallic alloy.

The above bear date September 20th.

2299. Thomas Richardson, of Newcastle-upon-Tyne, for improvements in the treatment of bones, and in the manufacture of paper.

2300. David Murray, of Norwich, for improvements in means or apparatus used in weaving.

2301. Calvin B. Rogers, of Deep River, Connecticut, U.S.A., for an improved floor skate,—being a communication.

2305. Thomas Martin, of Manchester, for an improved method of connecting and disconnecting pipes or tubes.

2306. Henry Edward Skinner, and William Henry Miller, both of Shadwell, for improvements in cranes and other lifting apparatus.

2307. James Campbell, of Adelaide-road, Haverstock-hill, for a chambered floating dry-dock.

2308. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in rotary engines and rotary pumps,—being a communication.

2309. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved mode of producing relief-printing plates, blocks, and cylinders,—being a communication.

The above bear date September 21st.

2310. Thomas Fallows, of Farnworth, near Bolton-le-Moors, and Richard Wild, of Bolton-le-Moors, for improvements in fasteners for window sashes.

2311. John Howell Wells, of Brooklyn, U.S.A., for improvements in rocking-chairs.

2312. John Tomlinson, of Nottingham, for improvements in fire-engines.—

2313. Thomas Griffiths, of Birmingham, for a new or improved pulley for window and other blinds.

2314. Robert Ash, and Joseph Letiere Petit, both of Birmingham, for improvements in metallic pens and penholders.

2315. John Jephson Rowley, of Rowthorne, Derbyshire, for improvements in machinery for cutting or clipping hedges.

2316. Joseph Henry Tuck, of Great George-steeet, Westminster, for improvements in air pumps, and in machinery for actuating the same.

2317. John Leggett Budden, of Fenchurch-street, for improvements in the application of steam, or highly rarefied gas, or other aeriform fluid, to obtain motive power for propelling and other purposes,—being a communication.

2318. Edward Bruce Boughton Barker, of Bayswater, for improvements in apparatus for raising or forcing water or other fluids.

The above bear date September 22nd.

2319. Edwin Gaskill, of Sermon-lane, Doctors' Commons, for the application of a traversing set-off sheet to gripper printing machines of all kinds.

2320. George Parsons, of Duke-street, Finsbury, for certain improvements in breaks for railway carriages.

2321. Joseph Hine, of Clerkenwell, for improvements in markers for billiards, cricket, whist, or other games of skill or chance, a modification of which is also applicable for indicating years, months, days, and dates.

2322. John Henry Johnson, of Lincoln's-inn-fields, for improvements in machinery or apparatus for washing and wringing clothes and similar articles,—being a communication.

2323. Henry Batchelor, of Southampton-buildings, Chancery-lane, for improvements in the apparatus and means employed for the production of geometric or ornamental figures or designs.

The above bear date September 24th.

2324. Josiah Vavasseur, of Gravel-lane, Southwark, for improvements in machinery for rolling or polishing leather.

2325. Carl Kind, of George-grove, Holloway, for improvements in pianofortes.

2326. John Haworth, of Thorncliffe, Old Trafford, near Manchester, for improvements in tramways for streets and ordinary roads, and in carriages for running thereon.

2327. John Robinson Porter, of Wood-street, for improvements in axles for railway carriages and other purposes,—being a communication.

2328. James Ball Mannix, of London, for an improved wheel to be used for carriages or other purposes.

2329. Edward Collier, of Myddleton-street, Clerkenwell, for improvements in respirators.

2330. William Gossage, of Widnes, Lancashire, for improvements in the manufacture of certain kinds of soap.

2331. Robert Geoghegan, of Dublin, for improvements in machinery or apparatus for expressing liquids from various substances.

The above bear date September 25th.

2333. Thomas Seaville Truss, of Gracechurch-street, for improvements in apparatus for the traction and propulsion of ships, boats, and other nautical vessels.

2334. William Hollis, of Sheffield, for an improved composition for steel moulders.

2335. Walmsley Hargreaves, of Crawshaw-booth, near Rawstentall, for improvements in machinery or apparatus for washing woven fabrics.

2336. Charles Burn, of Delahay-street, Westminster, for improvements in the tram-rails of street railways, to prevent horses slipping thereon.

2337. Charles Burn, of Delahay-street, Westminster, for an improved tram-rail for street railways.

2338. Friederich Wilhelm Daehne, of Swansea, for improvements in extracting copper from ores.

2339. William Boulton, of Burslem, Staffordshire, for an improvement in the construction of potters' drying stoves and workshops, and in apparatus for preparing the clay for the moulds used by the potter, so as to render the process of drying more effectual.

2340. Joseph McCrossan, of Glasgow, for improvements in sewing machines,—being a communication.

2341. William Macnab, of Greenock, Renfrewshire, N.B., for improvements in steam-engines and boilers.

The above bear date September 26th.

2343. William Fulford Brown and Walter Jeffery, both of Gloucester, for a more convenient and effectual method of attaching and securing brooches and such like articles, and for improved fastenings to be used therewith, and for other purposes.

2344. Thomas Brookes and Thomas Adams, both of Birmingham, for an improvement or improvements in the manufacture of the joints of brooches, and other similar dress fastenings.

2345. Marc Antoine François Mennons, of Paris, for improved processes for dyeing or printing with certain products of aniline on cotton, and other textile matters of vegetable origin,—being a communication.

2346. Joseph Jepson Oddy Taylor, of Mark-lane, for an improved composition for vessels, furnaces, and other apparatus to be exposed to the opera-

tion of great heat, and the effect of fluxes, and the like.

2347. John Henry Johnson, of Lincoln's-inn-fields, for improvements in forging and rolling metals, applicable to the manufacture of wheels, spades, shovels, axles, buffers, and other articles of wrought iron,—being a communication.

2348. Moritz Jacoby and Joseph Stones, both of Nottingham, for improvements in the manufacture of bobbin-net or twist-lace, in bobbin-net or twist-lace machines.

2349. William Hodgkinson, of New Lenton, Nottinghamshire, for improvements in machinery or apparatus in the manufacture of figured laces made on bobbin-net machines.

2350. James Wirram, of Liverpool, for improvements in machinery for the manufacture of casks and other like vessels of capacity.

The above bear date September 27th.

2351. William Arena Martin and James Purdie, both of Upper Ground-street, for an improved method of mounting and giving motion to fire-bars.

2352. Augustus Frederick Sheppard, of Moorgate-street, for an improved method of and apparatus for plate printing,—being a communication.

2353. Henry Gilbee, of South-street, Finsbury, for an improved medicament to prevent and cure venereal diseases,—being a communication.

2354. James Aspell, of Middleton, Lancashire, and Edward Booth and James Hurst, both of Tonge, near Middleton, for a certain improvement in power-looms for weaving.

2355. George Henry Birkbeck, of Southampton-buildings, for improvements in electro-magnetic apparatus—being a communication.

2357. John Alexander Callander, of Springfield House, near Ryde, for an improved method of hanging doors.

The above bear date September 28th.

2358. Charles Green, of Winnington, near Northwich, for improvements in the manufacture of salt.

2359. William Green, of Limehouse, for improvements in refining or treating sugar and molasses.

2360. John Roberts, of Upnor, for an improved mode of, and apparatus for, harvesting corn and other crops, and ventilating granaries.

2361. Alphonse Delesalle, of Lille, France, for means and apparatuses used in steam-engines for expelling out of the cylinders the condensed water, and to employ this water for the alimentation of boilers.

2362. Henry Offergeld, of Eilendorf, near Aix-la-Chapelle, for improvements in drums, and apparatus connected therewith, for giving motion to shafts.

2363. Arthur Warner, of Threadneedle-street, for improvements in the manufacture of iron, steel, copper, lead, tin, zinc, and their alloys, and in the manufacture of coke.

2364. Thomas Robinson, of St. Helen's, Lancashire, for improvements in machinery for packing soda ash and other matters or substances in casks and other vessels.

2365. Robert Mushet, of Coleford, Gloucestershire, for an improvement in the manufacture of cast steel.

The above bear date September 29th.

2366. John Clark, William Pollock, and James Whyte, all of Paisley, Renfrewshire, for improved apparatus for spinning or twisting.

2367. Elizabeth Steane, of Brixton, for improvements in apparatus by the use of which the dropping or guttering of candles is prevented.

2368. George Hulme, of Rochdale, Lancashire, for an improvement or improvements in the process of carding wool, cotton, silk, or other fibrous materials; and in machinery or apparatus applicable to that purpose.

2369. James John Field, of Holloway, for improvements in condensing the vapours arising from fluids evaporating in closed vessels, which invention is also applicable to the condensation of the vapours of volatile fluids during the process of distillation; and for improvements in apparatus to be employed for the purpose.

2370. Charles Henry Hurst, of Victoria-terrace, Kennington, and Henry Horsey and George Baker, both of Bridge-street, Southwark, for improvements in syphon and other taps or cocks employed for drawing off liquids.

2371. Michael Henry, of Fleet-street, for an addition to or improvement in

gas meters,—being a communication.

The above bear date October 1st.

2373. Robert Hellard, of Taunton, for improvements in reaping and mowing machines.

2374. James Parker, of Lilford-road, Camberwell, for improvements in propelling vessels by the buoyant power of steam, hot air, and vapour in combination, in rising through water.

2375. James Bullough, and John Walmsley, both of Baxenden, near Accrington, Lancashire, for improvements in looms.

2376. Robert Whittam, of Accrington Lancashire, for improvements in pentagraph machines used for engraving metal rollers or cylinders employed in printing calicoes and other surfaces.

2377. Bamfyeld Henri Francis Macnamara, of Great Yarmouth, for improvements in the construction of floating breakwaters, adapted for the facile and economic formation of harbours of refuge and other such purposes.

2378. John Thomas Robinson, of Bradford, Yorkshire, for improvements in screw-gill apparatus for combing wool and other fibrous materials.

2379. William Greaves Robarts, of Nottingham, for improvements in machinery or apparatus in the manufacture of fabrics made on warp machines.

2381. Peter Gardner, and Andrew Lindsay, both of Stirling, N.B., for improvements in knives for reaping machines.

2382. Henry Chatterton Rush, of Spencer-road, Putney, for improvements in fences for railway platforms.

2384. Godfrey Rhodes, of Albemarle-street, and James Syme, of Bishopsgate-street, for improvements in tent frames, and in rendering coverings for tent frames, and other textile fabrics, fibres, and surfaces, waterproof.

The above bear date Octorer 2nd.

NEW PATENTS SEALED.

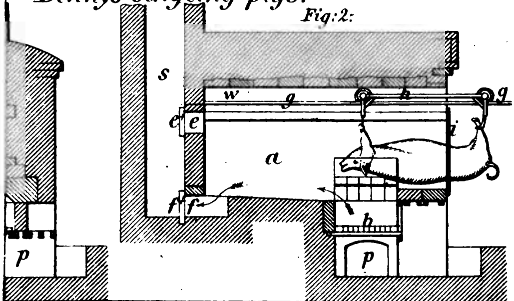
1860.

744. J. S. Bell.
786. A. R. Le Mire de Normandy.
789. Edward Pohlman.
791. Matthew Craufurd.
793. James Langstein.
796. John Weems.
797. Carl Barthélemy.
798. J. L. Hancock.
800. Edward Ewer.
801. A. P. P. Dagron.
804. R. H. Collyer.
805. S. R. Smith.
807. G. Haseltine and J. A. Knight.
809. James Farmer.
810. Isaac Holden.
813. John Monks.
815. N. and R. Smith.
820. James Reidy.
824. J. Davies and G. Paine.
826. W. M. Chambers.
827. S. B. Haskard and J. and E. Dean.
828. R. Lakin and J. Wain.
836. R. A. and M. Jefferson.
838. H. and J. Jones.
841. J. S. Starnes.
843. R. A. Brooman.
846. Cecil Johnson.
847. James Robertson.
848. William Houldsworth.
855. W. Rimington and W. Rimington, jun.
857. Joseph Schloss.
861. Thomas Ingram.
862. A. Pullan and T. Cresswell.
867. Archibald White.
868. William Leuchars.
869. J. H. Fuller and W. Davidson.
870. Vincent Rola.
871. J. H. Wilson.
872. William Parsons.
874. J. H. Johnson.
875. John Smith.
877. A. V. Newton.
879. Henry Carter.
883. H. L. Hall.
886. Job Hamer.
887. Henry Bridle.
889. T. Parker and G. Harrison.
891. Thomas Aveling.
896. Edwin Heywood.
898. W. E. Newton.
899. J. Rigby and W. N. Norman.
900. John Rankin.
903. Robert Atkinson.
905. T. H. P. Dennis.
909. Thomas Martin.

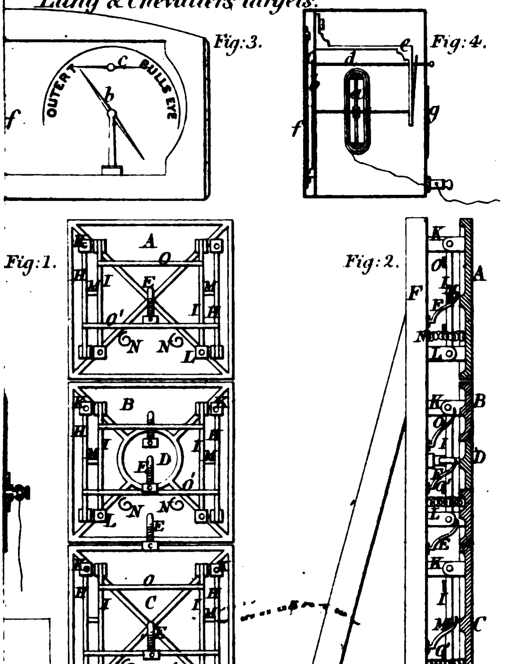
910. J. F. Hillel.
912. Charles Newbold.
913. John Webb.
914. Meyer Drukker.
917. J. Bushell, W. Bushell, S. Bushell, J. Bushell, and D. Bushell.
918. Hugh Smith.
921. Origen Vandenburgh.
922. John Platt.
924. Adam Bamlett.
926. A. Mitchell, J. Mitchell, and B. Emmerson.
927. J. W. Crossley and J. Crossley.
932. E. J. Hughes.
933. J. J. L. Bremond and L. Z. Thuilliez.
934. John Notman.
937. Félix Fontenau.
938. L. M. Boulard.
939. Abraham Jones.
940. John Petrie, jun.
943. Sir J. S. Lillie.
949. Thomas Burstall.
951. Thomas Walker.
952. William Smith.
953. J. B. A. Carpentier.
954. D. G. Fitzgerald and G. Bate.
957. William Clark.
959. Charles Stevens.
961. J. H. Johnson.
962. John Patterson.
963. Gustave Hansemann.
966. Samuel Cheetham.
967. William Bridgett.
969. W. E. Newton.
971. J. Shaw and J. Cook.
974. J. Fowler, jun., W. Worby, and D. Greig.
980. Bernard Lauth.
981. S. Wheatley and A. Milnes.
985. J. Dale and H. Caro.
988. C. F. Sebille.
990. Richard Roberts.
994. H. A. Silver and J. Barwick.
995. William Lukyn, Sen.
996. A. Denny and E. M. Denny.
999. T. A. Hedley and G. H. C. Hedley.
1002. Joseph Lewtas.
1003. E. Peyton and W. F. Batho.
1004. William Buckwell.
1005. William Buckwell.
1008. John Parkinson.
1010. J. A. Phillippe.
1015. Alexander Ritchie.
1017. E. Hillam and R. R. Wilson.
1019. Edward Wilkins.
1020. D. G. Berri.
1022. Edward Gatwood.
1025. C. E. Albrecht.
1027. William Clark.
1028. J. W. Ford.
1035. Carlo Minasi.
1037. G. J. Parker.
1038. James Mason, Jun.
1040. X. Tarte and W. Toovey.
1041. Robert Seager.
1045. J. Clark and W. Cross.
1048. William Bate.
1057. William Northen.
1078. The Right Hon. Lord Berwick.
1084. John Grantham.
1089. H. T. Green and S. B. Wright.
1095. Francis Preston.
1101. Alexander Bain.
1119. T. Heatley and W. Paddock.
1130. W. E. Newton.
1134. J. H. Johnson.
1135. John Corbett.
1152. J. Howard and J. Lilley.
1155. R. B. Boyman.
1168. Thomas Wilson.
1182. Edward Lord.
1184. W. E. Newton.
1196. W. E. Newton.
1207. A. V. Newton.
1266. William Clissold.
1275. R. H. Collyer.
1313. J. H. Johnson.
1318. Eugène Dufossé.
1337. W. R. Bowditch.
1364. William Taylor.
1406. M. Jacoby, J. Redgate, & J. Stones.
1426. F. C. Calvert, C. Lowe, and S. Clift
1438. Robert Hyde.
1447. John Lancaster.
1456. Edward Sparkhall.
1560. John Macintosh.
1570. Westley Richards.
1574. Thomas Wilson.
1593. Hobert Henry Bishop.
1598. Charles Stevens.
1631. W. F. Thomas.
1711. W. F. Henson.
1731. Edward Loysel.
1772. Marc Antoine François Mennons.
1781. J. W. Sullivan.
1793. W. E. Newton.
1794. Sir P. Fairbairn and J. Barrow.
1795. W. E. Taylor.
1807. A. V. Newton.
1837. John Hamilton, jun.
1861. Joshua Jackson.
1863. Joseph Roberts.
1887. Jacques Rives.
1888. E. U. Thompson.
1981. Alfred Fryer.
1991. R. Mole and F. M. Mole.
2019. H. M. Clarke.
2021. E. A. Dana.
2049. F. G. M. de Baran.

**** For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

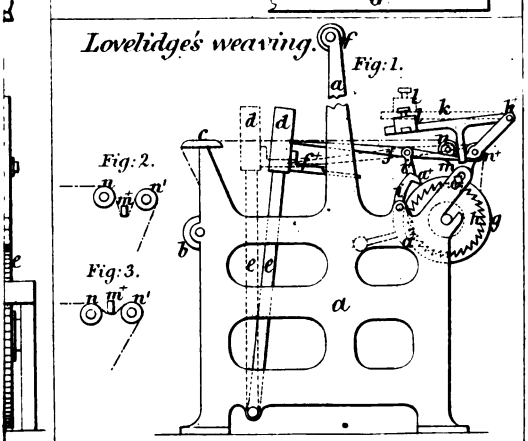
Dennys' singeing pigs.



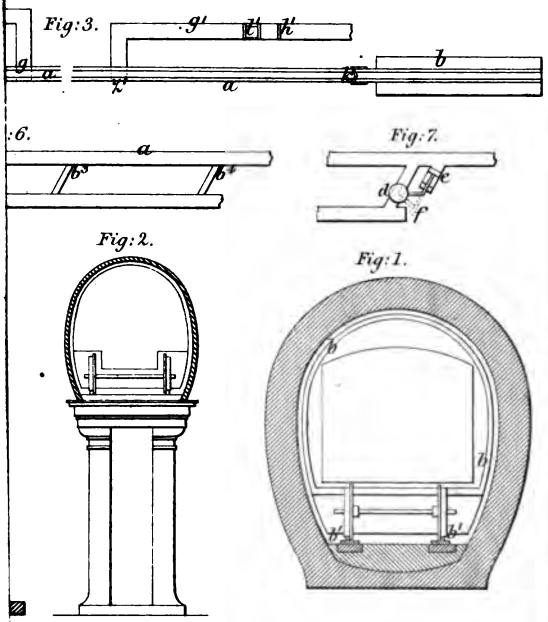
Lang & Chevalier's targets.



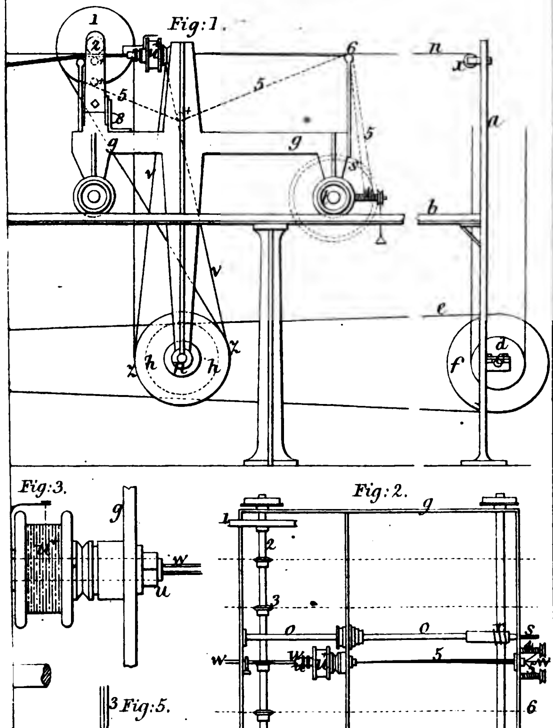
Loveliges weaving.



pneumatic tubes.



Rickard's chenille.



C. Pilling, lith.

NEWTON'S
London Journal of Arts and Sciences.

No. LXXII. (NEW SERIES), DECEMBER 1st, 1860.

PROLONGATION OF PATENTS IN THE ENGLISH AND AMERICAN COURTS.

THE first day of December, 1860, will long be memorable in the history of patents, by reason of the expiration of one of the most important of these grants that is to be found on the patent rolls. Fourteen years have now passed since the little sewing machine, destined to emancipate that hope-forsaken class so pathetically described in Hood's "Song of the Shirt," was presented to the writer by the inventor's brother, with the object of securing a purchaser of the right to patent the same in this country, and thereby providing funds for the better prosecution of the invention in the United States. That the machine, in its then state, had merits, was evident enough to any one acquainted with the operation of machinery; but that it was capable of effecting what, by some slight modifications, it was ultimately found equal to, no one, at that period, would have anticipated: it will not, therefore, be wondered at that this invention, which has of late met with almost unexampled success, was parted with on easy terms—the inventor being then but a needy mechanic—or that the purchaser for a long time failed to perceive that he had made a most advantageous bargain. Many years were required to establish the value of the English patent, and, indeed, it does not appear that the American patent produced any returns during the first six years of its existence. We do not now refer to the original patent of the sewing-machine, with the view of extolling the merits of Mr. Howe, its ingenious inventor, and much less is our object to prejudice the public against the English patentee of the invention, Mr. Thomas, but we now bring forward the subject in these pages, in order to ascertain whether a practical lesson may not be drawn from the circumstances surrounding this invention, of service to the owners of British patents. In brief, we propose to contrast the treatment which British and American patentees receive under similar although not identical laws.

By the patent laws of each country the first and true inventor of any new manufacture may secure to himself the exclusive use of his

discovery for fourteen years, and if he can show that, during that period, from no avoidable neglect of his own, he failed to derive an adequate remuneration from his ingenuity, he is entitled to an extension of the grant, in England through the recommendation of the Privy Council, and in the United States, by a decision of the Commissioner of Patents. The rule holds good, and is indifferently quoted in each country, that the claim to an extension of a patent rests mainly on the proportion which the patentee's profits bear to the advantages derived by the public from the invention. Thus, Lord Brougham, in deciding on Derosnes's case (sugar refining) before the Privy Council*, said :—"Their lordships find that, unlike some other patentees who have realized no profit, a very reasonable profit has already been made. Under these circumstances, were it not for the great benefit which the public has derived from the patent, *while the patentee has not derived a benefit to the same extent*, their lordships probably would not have recommended the granting so large an extension as they feel now disposed to do, &c." And again, the same learned judge, in giving the decision of the court in Muntz's sheathing metal case, after remarking on the novelty and utility of the invention, said :†—"The only question is, therefore, whether or not Mr. Muntz has already received a sufficient remuneration from the patent which he has obtained for that valuable and meritorious invention . . . . We must ascertain whether he has, in the eyes of men of ordinary but enlightened understandings (judging fairly between him and the public), had a sufficient remuneration." These are the comments of the noble lord on the prolongation clause of the Act which bears his name (5 & 6 Will. IV. cap. 83), and by which, coupled with a subsequent Act (7 & 8 Vic. cap. 69), permission is granted to patentees to petition the Privy Council for an extension of their patents for a term of fourteen years beyond the term of the original grant; instead of being left, as heretofore, to resort to to Parliament, which favourably entertained only the most extreme cases of hardship, and was always liable to be swayed in its decision by personal or political influence. In a like spirit the law under which American patentees seek an extension of their rights, enacts that every applicant shall furnish to the examining board a statement, in writing, on oath, of the ascertained value of the invention, and of his receipts and expenditures, sufficiently in detail to exhibit a true and faithful account of loss and profit in any manner accruing to him from and by reason of the invention; and if, having due regard to the public interest therein it shall appear that the patentee has failed to obtain a reasonable remuneration for the time, ingenuity, and expense bestowed on

* See Webster's Reports, Vol. II., p. 4.

† Webster's Reports, Vol. II., p. 119.

the invention, it shall be the duty of the Commissioner to renew and extend the patent. But if the principle which governs the enquiry and the decisions of the Courts in both countries be the same, the character of the decisions should agree. Let us see if this be so, and for this purpose we will take the case of the sewing machine patent, for which a renewal was recently sought in both countries, although under somewhat different circumstances; the application for which was abandoned without a hearing in England, while it was prosecuted to success in the United States. According to the rules of the American Patent Office, the applicant has to prepare his statement under five different heads, viz.:—I. Novelty of the invention—embracing the history of its origin and proof of the validity of the patent; II. Utility of the invention—setting forth its special merits; III. Public value of the invention—to show the extent of its appreciation by the public, and the gain accruing to the nation from its use; IV. Remuneration for the invention—giving not only the profit, if any, derived from its use, but the causes for the assumed insufficient reward obtained by the inventor; V. Diligence in introducing the invention into use, and explaining the cause, where such exists, of the tardy exercise of the invention by the public. This statement, then, in conformity with the common practice, Mr. Howe, in applying for an extension of his patent, prepared and subscribed to on oath, accompanying it with such documentary evidence as was deemed necessary by his legal advisers to support the various general allegations contained therein. From the able argument of his counsel, Mr. Giffard, who holds a high position in his profession, we are enabled to collect the substance of the evidence on which he relied for substantiating the claim of his client to an extension, in the face of that formidable fact, that the clear receipts from the working of the patent had already exceeded £97,000 (468,632 dollars). It is interesting to follow this argument a little, for it is calculated to clear our minds somewhat on a subject, which, up to the present time, has not been understood in this country, and which it behoves us to consider, before pronouncing, as we are all apt to do, when an inventor has received ample remuneration for his discovery. Mr. Giffard boldly handles the, to us, very staggering fact, that the inventor's gains are £97,000, and shows how small a proportion that bears to the profit derived from the invention by the public. Having set forth the practice of the Court, as evidenced by recent cases in which the ratio between the profit and the public value of the invention was such as to induce the Commissioner to recognize the right of the inventor to an extension, he proceeded to show that, in the case of Mr. Howe, the disproportion was far greater than had hitherto been deemed sufficient to

secure the success of the application. Thus, dividing the labour of which the sewing machine was capable, under its several heads, as—men's and boys' clothing—hat and cap manufacture—shirt bosoms—shirts—boots—bags—ladies' cloaks and mantillas—satchels, carpet bags, &c.—carriage trimming—upholstery and furnishing, &c.—and taking seven of these heads on which he has evidence to base a calculation, he says :—"The aggregate of the saving by the sewing-machine, as above shown, amounts to one hundred and three millions seventy-one thousand nine hundred and thirty dollars; and it is to be borne in mind, that this is a saving of only a small portion of the departments in which the machine is used, and in most of these, as mentioned, limited to the City of New York; and it may well be asked here, what saving has the sewing machine accomplished, and what is it destined to accomplish in the whole United States, saying nothing of the entire world?" After roughly estimating the value of the machine in other branches, and making a large allowance for the improvements suggested by other inventors, he comes back to this sum as the annual saving effected by Howe's invention. In various ways he further tests its pecuniary value, and taking credit for only half the saving manifestly due to the introduction of sewing machines, and dividing this sum by the profit realized by the patentee, he obtains as the result "a saving every year of more than one hundred and three times the amount of all the profits which Howe has ever received. That is, it gives a ratio between profit and value of 103, larger by 63 than was the ratio between profit and, not only the annual but the entire, value in Goodyear's case."*

By this course of argument, Mr. Giffard was enabled triumphantly to dispose of the question of sufficient remuneration, and leave the Commissioner of Patents no choice but to extend the grant; for if any disposition had existed on his part to look upon Mr. Howe's realized profits as a sufficient recompense, he could not but feel debarred from thus deciding upon the case in the face of the judgments cited by the learned counsel. Thus, Commissioner Holt, in deciding (June, 1858), on the Goodyear case before mentioned, was reported to have said:—"If this process is worth two millions of dollars, the applicant has received but a little more than one-fortieth part of the remuneration which he was entitled to claim." And again, on the application of Thaddeus Hyatt, Commissioner Bishop, (November 4th, 1859,) adopting the same rule, said—"If the amount paid by the public for a

* The case here referred to was an application for the extension of the late Mr. Charles Goodyear's patent, for vulcanizing india-rubber, in which the value of the invention was shown to be two millions of dollars, and the profit realized, fifty-four thousand seven hundred and thirty-three dollars: the ratio between profit and value being forty.

particular improvement, which they consider necessary for them to use, is greater than the benefit derived from it, they have just right to complain, and to protest against a patent therefor. But, if on the other hand, the benefit which the public has received, far outweighs the profits which the inventor has realized, such complaints and protests might be regarded as unjust and unreasonable."

Such then being the ascertained practice under the American law, our next point is to consider how it accords with the operation of our own system of prolongation. We have already shown that in principle the English law, as interpreted by Lord Brougham, accords with the judgments of the American Commissioners of Patents, inasmuch as in both countries the fact of the patentee not deriving a benefit to the same extent as the public, constitutes the ground for applying for an extension; but does the practice of the Privy Council bear out the principle of equal distribution, or anything like an equal distribution, of profits between the public and the patentee? If it be so, we must say, that professional men engaged in promoting or opposing the extension of patents have failed hitherto to discern the working of this or any other intelligible principle in the decisions of the Court; and that a considerable amount of uncertainty hangs over these cases may well be inferred—first, from the small number of petitions entered for extension since the passing of the Act in 1835; and secondly, from not a moiety of the petitions being granted. Up to the present time, we find there have been 118 applications made for prolongation of patents, of which only fifty-seven were granted; the remainder being either dismissed, from presenting no sufficient grounds for an extension, or waiting to be heard, or withdrawn before a hearing was appointed, from the hopelessness of substantiating a case for extension, in the face of an organized or determined opposition. Thus, Mr. Thomas's petition for a prolongatiou of the sewing machine patent, although grounded, like that of Mr. Howe, on insufficient remuneration, and doubtless, with equally good reason, was wisely withdrawn, because the most experienced practitioner before the Privy Council would certainly have failed to discover a precedent on which to base a hope of success. A reference to the decisions which proved favourable to patentees will at once establish our position. Taking them in chonological order, we find Galloway's patent (paddle-wheel), extended in 1843, for five years; the losses of the petitioner in respect of the patent having amounted to £8000. In the same year, Wright's patent, under which the Minton tiles are made, was extended for seven years, the patentee having expended between £700 and £800, and received but £100 as royalty. Then we come to Derosne's application above mentioned, where a case of profit had to be dealt with. The invention was, however, proved, to the satisfaction of

the court, to be "a very considerable and valuable benefit to the public." Yet, notwitstanding this, the profit of £3350 was termed by Lord Brougham, "a very reasonable profit;" and it was only because of "the extent of the benefit to the public," that their lordships were induced to recommend a prolongation for six years. In the case of that very valuable invention, Perkin's hot-water pipes, by which a profit of £7498 was made, Lord Brougham, in pronouncing for an extension of five years, when speaking of the "considerable profit" obtained by the patentee, qualified the term by the guarded expression of, "though not, perhaps,exorbitant." If the profit of £7000 on the working of an original invention during fourteen years only just escapes being "exorbitant," what would the same tribunal have said to Mr. Howe's application, which showed the little addition of £90,000? We much fear, that the recognised principle of equal benefits to the patentee and the public, would have been scared from their remembrance by the presence of such an enormous fact. Without unnecessarily citing examples, we may say, that the extension in 1835, of Erard's piano-forte patent, for seven years, was obtained on proof of the loss of £15,000. So also, in the working of Wright's pin machine patent, was there a somewhat similar loss, for which an extension for five years was granted in 1837. Roberts's self-acting mule patent obtained, in 1839, an extension for seven years on proof of a profit gained of £7000, but more than balanced by a loss of £10,000 from a supposed incendiary fire (the invention having met with rough treatment from the spinners). And to refer to later decisions, the extension, in 1852, of Porter's anchor patent for six years, was obtained on the proof of a loss of £15,000; and that of Heath's steel patent, was extended for seven years, for the benefit of his widow,—no receipts, but expenses only, owing to systematic infringements, having resulted therefrom.

If now we turn to the other side of the picture, and take the case of Muntz's yellow metal patent (for ships' sheathing), we shall find how careful the Privy Council are to guard against the possibility of exorbitant profits being obtained by patentees. The petitioner, in this case, sought for an extension on the usual ground of inadequate remuneration, admitting, at the same time, his profits to amount to £55,000. He showed the very gradual introduction of the invention, and that it could only be effected by enormous guarantees, which would not have been accepted except from a firm of acknowledged wealth; and he also proved the value of his sheathing as compared with that of copper—the saving being from 17 to 20 per cent. in favour of the yellow metal; yet, with all this evidence, their lordships would allow of no apparent diminution of the patentee's profits by reason of manufacturer's profits, but decided against the patentee, that "there has been an ample remunera-

tion—not more than he deserved—not to be grudged him—but still sufficiently ample to disentitle him to the interposition of this Court." Now we by no means complain of this decision, for the Council was compelled to form a judgment on the evidence before them, and what evidence was there to show the inadequate nature of Mr. Muntz's remuneration? There were, it is true, some of the elements for eliminating such evidence, but this labour it was not the business of the Court to undertake. We have chosen this case for special comment because it approximates more closely than any other to that of Mr. Howe; but mark how differently the two cases were treated. Howe sets out that there are now in use 100,000 sewing-machines in the United States, all of which, no matter what their form, were derived from his, the parent invention. Muntz gives year by year the number of ships sheated by the metal manufactured at his works; but a considerable decrease in the last year in the list is accounted for by "the licensed metal coming in, which took part of our trade." This important fact, which showed the wide spreading of the manufacture, and consequently its increased appreciation by the public, is entirely overlooked, and no estimate of its public value, further than its superiority over copper being from 17 to 20 per cent., is even attempted to be advanced; the explanation, such as it was, being perhaps drawn forth by the remark of Lord Lyndhurst in Downton's extension case,* to the effect that the evidence must show a gradual increase in profits, and not that "I have only made £200 a year; I want to make the same sum so many years more." The evidence, however, adduced in Howe's case, to show the public value of the invention, is so elaborately built up as to carry conviction of its reliableness. Thus, a witness connected fifteen years with the clothing business is brought forward to detail the results of a series of experiments with the leading machines, on different kinds of work, as contrasted with hand-sewing. He also estimates that "New York does one-tenth of the clothing business of the United States. And again, "a girl and a machine can do the work of nine girls in making the grocery bags for flour. There are four hundred hands employed in the United States, making these bags by machines." Another witness, acquainted with the extent of the mantilla and cloak trade of New York, estimates it at about three millions of dollars per annum,—the proportion done by machines, being one-third, and each machine doing the work of six hands. This witness, further says, as a consequence of cheapening garments, there is an increased demand and supply. "With an increase of machines, there is also an increase of hand-sewers, to prepare the work for them, and also to do that

* Webster's Reports, vol. i., p. 567. See also *Macpherson's Practice of the Judicial Committee*, 1860.

part of the work which the machines cannot do." Another witness, who is a maker of shirt fronts, averages his work at a hundred dozen a day, "which is not one-thirtieth of the machines' work turned out in New York and its vicinity." And so on through the various branches of trade to which sewing machines apply, evidence was collected to show to what extent it had displaced manual labour, and in what instances it had established new branches of industry.

From an accumulation of such facts as these, the public value of the invention was adduced, and the claim for an extension of Howe's patent —notwithstanding his returns, at the time of making the claim, equalled £50,000 per annum—was established. On a review of the Privy Council's decisions, we see no reason why a like result, under similar treatment of the case, should not be looked for with certainty. At any rate, we would advise, that the experiment be forthwith tried with the pending cases, whether they represent an approximation to an exorbitant profit or not; for, under any circumstances, the aspect of the case must improve with such treatment; and if the application fails, there will be at least an approach made to a definite understanding of the hidden laws which dictate the Privy Council's decisions.

RECENT PATENTS.

To BENJAMIN MATTHEWMAN, Jun., *of Sheffield, for improvements in pen and pocket knives, scissors, and every other description of cutlery.*— [Dated 30th January, 1860.]

THIS invention consists in inserting photographs or pictures of any description in the handles or blades of knives, scissors, and every other description of cutlery.

The photographs are taken in the usual way, either on glass, paper, or other substance, and are then inserted in a recess or opening made for the purpose in any desired part of the handle or blade of the article, and secured therein by rivets, screws, expanding rims, or cement, according to the description of handle or blade for which the photograph or other picture is required.

Pictures of any description, or copies taken by any process, may be inserted in like manner, thereby ornamenting and improving the appearance of all descriptions of cutlery ware.

The patentee claims, "the ornamenting of pen and pocket knives, razors, scissors, and other articles of cutlery, in the manner described."

To JOSEPH WILLIAM WILSON, *of Buckingham-street, Strand, for improvements in apparatus for cleaning guns.*—[Dated 7th January, 1860.]

THIS improved apparatus for cleaning guns consists of a flexible tube, made by preference of vulcanized india-rubber, and fitted at one end into a brass or other socket, of such a size as to fit over the nipple of the gun. The socket has a head formed on it, on to which the hammer may rest, so as to hold the socket firmly in its place. The apparatus is employed in the following manner:—When the tube has been fitted on to the nipple, as above described, its other end is placed in a vessel containing water; the head of the ramrod, with a piece of tow or rag wrapped round it, so that it may fit the barrel loosely, is then introduced into the barrel, and being worked up and down in it, it alternately sucks up water into the barrel through the nipple, and forces it back again into the vessel from which it was drawn, and the barrel is thus rapidly cleaned. A ferrule is placed round the end of the tube which enters the water vessel, in order to give it weight sufficient to keep it therein.

The figure in Plate XI., shows a side view of the apparatus complete. *a,* is the tube of vulcanized india-rubber, and *b,* the metal socket, through which one end of the tube *a,* is drawn, and it is this end which is fixed on the nipple when the apparatus is about to be used. *c,* is a short tube of metal introduced into the other end of the tube *a,* to give weight thereto.

To JOHN DEANE and JOHN DEANE, jun., *of King William-street, City, and* WILLIAM HARDING, *of Forest-hill, for improvements in breech-loading fire-arms,—being partly a communication.*—[Dated 23rd March, 1860.]

THIS invention is more especially applicable to breech-loading fire-arms for sporting purposes, where it is desired to project several shot or bullets simultaneously. For this purpose the barrel of the gun is composed of an assemblage of small hexagonal barrels, bored from end to end, the number of which depends upon the number of bullets desired to be projected at one and the same time: the bores of the barrels may, if desired, be rifled.

In Plate XII., fig. 1, is a longitudinal section of a breech-loading fire-arm constructed according to this invention. The parts of the piece in this figure are in the position they assume when the piece is ready for firing. Fig. 2, is a side view, partly in section, of the same fire-arm, showing the parts in the position they assume when the barrel is turned down for the piece to be loaded. *a, a,* are a number of hexagonal barrels of equal length; these barrels are held together at each of their ends by rings or ferrules *b, b,* and it is preferred that the barrels should, in addition, be soldered together; the exterior of each of the barrels being coated with a soft metal before putting the barrels together. Each of the barrels is bored through from end to end, and the bores of the barrels may, if desired, be rifled. On the exterior of the ring or ferrule *b,* embracing the rear end of the assembled barrels *a,* is a screw-thread, portions of the screw-thread being cut away as shown. *c,* is the breech-plate fixed to the stock of the fire-arm: this plate is for the purpose of closing the ends of the barrels *a, a.* Projecting from the plate *c,* is a tube or cylinder

c^1, in the interior of which there is a screw-thread, and portions of this screw are cut away, so that the segments of the screw on the ring *b*, may pass between the segments of the screw left in the cylinder c^1, and the ring *b*, may thus be slidden up to the plate *c*, and the barrel may then be locked in position by causing it to make a partial revolution. The barrels are prevented from being entirely detached from the breech by the handle b^1, on the under side of the ring *b*, having a hole formed in it, through which the bar *d*, passes, there being a stop at the end of the bar to prevent the handle from sliding off its end; and in order that the barrels may be turned partly round, the bar *d*, is hinged to a sliding piece *e*, which is capable of sliding partly around the cylinder c^1: this sliding piece is kept in position by the guide e^1. *f*, is the moveable plate for containing the bullets, a number of holes being formed through it, corresponding to the bores of the assembled barrels. In each of these holes a screw-thread is cut, in order that the rear end of the bullets may be screwed into them. In the plate *c*, holes or chambers are also formed, corresponding to the bores of the assembled barrels. These chambers are for receiving the charges of powder. Small holes are bored from the bottom of one chamber to the bottom of the chamber next to it, so that when the charge of powder in one chamber is discharged, those in the other chambers will be discharged also. The charge of powder in one of the chambers is discharged by a cap placed on the nipple *g*. When loading the piece, the barrels *a*, are turned down into the position shown at fig. 2. The chambers in the plate *c*, are then filled with powder, and the points of the bullets contained in a plate *f*, are inserted into the rear ends of the barrels *a*. The rear end of the assembled barrels is then slidden up to the plate *c*, and the barrels are locked in position, by causing them to make a partial revolution; and the piece is then ready to be discharged. Fig. 3, shows the arrangement for connecting the barrels *a*, *a*, to the breech-plate *c*, in which the ring or ferrule *b*, embracing the rear ends of the assembled barrels, is hinged at its under side to the under side of the breech-plate *c*. In order to hold the rear ends of the barrels against the breech-plate when the piece is ready for firing, the upper part of the ring *b*, is formed with a projecting piece *h*, and through this piece there is a hole into which the upper end of the locking bolt *i*, passes, and the rear end of the barrels are thus held against the breech-plate. The bolt *i*, can be withdrawn by turning down a lever *k*, hinged to the under side of the breech-plate, the lever *k*, being connected by a link *l*, to the bottom of the bolt *i*; when the bolt is withdrawn, the barrels may be turned down into the position shown in dotted lines. *j*, *j*, is the plate for containing the bullets: this plate has conical projections at each end of each of the holes formed through it, as shown at fig. 4; the conical projections on one side of the plate entering conical recesses in the rear ends of the barrels, and the conical projections on the other side entering conical recesses formed at the mouth of the holes in the breech-plate *c*. By this means a tight joint is secured between each of the passages. The plate *f*, in this arrangement, is made of a sufficient width to contain the bullets; the bullets being merely inserted into the holes. Fig. 5, is an end view of the front ring *b*, with the barrels removed. Fig. 6, is an end view of the breech-plate *c*; and fig. 7, is a side view of the plate *f*.

To JAMES ASPELL, *of Middleton, Lancashire, and* EDWARD BOOTH *and* JAMES HURST, *both of Tonge, near Middleton, for certain improvements in power looms for weaving.*—[Dated 20th March, 1860.]

THIS invention relates to a mode of regulating the take up of the cloth in power looms as the cloth upon the roller or beam increases in diameter from the accumulation of fabric.

In Plate XII., fig. 1, is an elevation of that portion of a power loom to which the improvements are applied; and fig. 2, is an end view of the same, partly in section. *a, a,* is the framing of the loom, and *b,* the cloth beam, which receives motion from the "swing or rocking" shaft *c,* through the medium of a toothed wheel, termed a conical or spiral ratchet-wheel *d,* for giving motion to the worm and worm-wheel *e, e,* or any other description of intermediate gearing. The swing-shaft gives motion to the spiral ratchet-wheel *d,* by means of pawls *f, f,* which are carried along the surface of the ratchet-wheel from the lesser diameter to the greater by means of the carrying bar *g,* which is actuated by the block or roller *h,* becoming depressed as the cloth beam fills, and causing the bell-crank lever *l,* to move so as to impart the necessary forward motion to the said carrier. *i, i,* is a vertical rod and lever, by means of which the pawls are lifted off the ratchet-wheel by the action of the "spring handle" *k,* when the loom is stopped. The action of the various parts is as follows:—As the cloth accumulates upon the cloth roller *b,* the block or roller *h,* bearing upon the exterior of the fabric upon the cloth roller becomes depressed, and by means of the bell-crank lever *l,* and carrier bar *g,* the pawls are gradually carried or transferred from the smaller diameter of the ratchet-wheel to the greater diameter; and thus the action of the pawls upon the wheel becomes diminished, and the cloth roller *b,* is caused to rotate at a gradually slower speed; and consequently an equal amount of cloth is taken up at each pick from the commencement to the completion of the piece.

The patentees claim, "regulating the taking up of the cloth by the novel application and use of a spiral ratchet-wheel or cylinder interposed between the cloth beam and the swing-shaft, and the pawls and mechanism connected therewith, as described."

To JOHN BLACKWOOD, *of Banff, N.B., for improvements in furnace or fire-bars.*—[Dated 21st March, 1860.]

THE object of this invention is to construct furnace fire-bars in such manner as to ensure the bars lasting much longer than those of the ordinary kind, as well as obtaining other advantages in the combustion of the fuel.

In Plate XII., fig. 1, is a partial sectional elevation of the improved furnace-bar, and fig. 2, is a transverse vertical section of the same; fig. 3, is a longitudinal section of a furnace fitted with the improved bar. The furnace-bar *a,* is cast or rolled hollow, that is to say, it has an opening extending longitudinally throughout its length. The external portion of the bar is by preference formed of an elliptical or egg-shaped figure, as shown in fig. 2. The wider portion of the egg-shaped figure forms the upper part of the bar, and the fuel rests upon the rounded upper surface

b, when the bar is fitted in the furnace. The ends of the bar are notched or recessed at *c*, in the ordinary manner, to admit of the bar resting on the cross bearer or supports which are fitted at each end of the furnace; and there are the usual laterally projecting parts *d*, which preserve the necessary longitudinal openings between the fuel-bearing portions of the bar. Below the bearing ends of the bar the metal is curved at *e*, so as to leave a good opening at each end for the admission of air. When fitted in the furnace, these openings admit of a current of air passing through each bar, and these currents of air are highly beneficial as regards the preservation of the bar, for by this means a large proportion of the intense heat imparted to the bar by the burning fuel is carried away, and its destructive effect upon the iron is counteracted by the cooling influence of the air flowing through the bar.

In fitting these bars in furnaces, preference is given to the arrangement delineated in fig. 3, for stationary engines. The brickwork *f*, is constructed in the ordinary manner—the bars *a*, rest upon the dead plate *g*, at the front ends, and at the back on the hollow bearer *h*; this bearer is built into the brickwork *i*, which forms the back part of the ash-pit and the fire-bridge. The hollow bearer *h*, extends across the furnace, and has opening into it, at each side, a pipe *j*, which is carried upwards in an angular direction, as indicated by the dotted lines in fig. 3, the extremity of each pipe terminating in the furnace above the fire-bars. The air which flows through the hollow bars being heated in its passage, passes into the chamber or hollow bearer *h*, and flows from it into the pipes *j*. The heated air issues from the pipes *j*, where it mingles with the smoke arising from the burning fuel, and serves to render inflammable the greater portion of the evolved gaseous matters, which are thus flashed into flame and utilized by imparting heat to the boiler *k*. The flame and gaseous current, after passing round the boiler by the flue *l*, are conveyed into the chimney. Instead of the foregoing arrangement, the heated air from the pipes *j*, or from the bearer *h*, may be allowed to escape either behind the fire-bridge, or be carried by means of a short pipe up through it, so as to ignite the combustible gases at the backward part of the furnace before they are allowed to escape to the chimney. By this mode of arranging and constructing furnace-bars, a large body of air is carried into the furnace, which serves, in the first place, to preserve the furnace-bars, and, secondly, to economise the consumption of fuel, by not reducing the temperature of the furnace, and thus preventing, or nearly so, the escape of visible smoke from the chimney.

The patentee claims, "First,—the general arrangement and construction of furnace or fire-bars, as described. Second,—the system or mode of constructing furnace or fire-bars of the peculiar figure or hollow form described, or any mere modification of the same. Third,—the system or mode of arranging the said furnace or fire-bars in furnaces, as described and delineated, with a view of utilizing the currents of air passed through the hollow bars."

To George Crawshay, *of Durham, for improvements in the manufacture of iron pulleys for winding from coal pits and other purposes.*—[Dated 22nd March, 1860.]

This invention consists in constructing the rims of iron pulleys, for winding from coal pits and other purposes, of wrought instead of cast iron, of which they have hitherto been made; the object of the invention being to construct pulleys of light weight, but at the same time of greater strength than when the rims are made of cast iron. These rims may be made either of iron rolled to a particular section suitable to the purpose required, or the section thereof may be made up in parts. For this purpose ordinary angle iron may be used for rims for round ropes, and channel iron for flat ropes, but the sectional form of the iron may be varied.

When the section of the rim is made up in parts, the body or barrel thereof may be formed of flat or square iron, and the flanges or sides secured thereto by rivets or bolts.

In Plate XII., fig. 1, is a side elevation of a pulley for round ropes; fig. 2, is a transverse section of half the pulley; fig. 3, is a transverse section of a pulley for flat ropes, in which the rim is made up in parts; fig. 4, is a similar section of part of a pulley in which the rim is rolled of one piece, to form the section; figs. 5, and 6, show other modes of constructing the rim in parts; and fig. 7, is a section of the rim of a round rope pulley formed in parts, in which the centre part *o*, may be made of wood, iron, steel, or other material, as circumstances may require.

The naves of these wheels may be made of cast or wrought iron, or a combination of both, as shown at fig. 3, where the spokes are let into pockets formed in the cast-iron centre-piece *c*, and covered by wrought-iron rings *a*, *a*, and secured by bolts or rivets passing through the whole; or they may be made as at fig. 2, in which case the nave is cast upon the spokes in the same manner as when the rims are made of cast iron of the usual construction.

The rings composing the rims of these pulleys may be bent into their required diameter over a curved mandril block, or they may be bent by a machine similar to that in general use for bending tyres of locomotive wheels, either in one entire length and welded at the junction of the two ends; or they may be made in segments, and joined together by side plates and rivets, as shown in fig. 1, at *b*, *b*.

The patentee claims, "the manufacture of pulleys with wrought-iron rims in the manner described, applicable to winding from coal pits and other similar purposes."

To James Rae, *of New Cross, for improvements in constructing iron ships, part of which improvements is applicable to the rivetting of boiler plates and others.*—[Dated 10th March, 1860.]

In Plate XI., fig. 1, is a vertical section of a ship's skin plates, showing the improved method of connecting the bulkheads to a vessel's side by means of single and grooved T-irons, instead of by one or two angle irons, as is generally used. *c*, *c*, are additional strengthening plates, which are made to fill up the space between the inside strakes of the

skin plates round the ship's body from gunwale to gunwale. These plates may be extended to the first, second, or third frames on each side of the bulkheads, and are made the same thickness as the inside strake of the skin plates; thus, there are two thicknesses of plates every alternate strake, doubling the strength where it is most required, and affording a perfectly smooth surface for the bulkhead frame to rest against. It also affords the means of making the bulkhead perfectly water-tight.

Fig 2, is a sectional plan of part of a ship's side, showing part of a bulkhead, and the mode of connecting the same by means of double or single T-irons. These T-irons answer as frames or timbers, having a broad base embracing a large portion of the ship's side, thereby greatly strengthening the plates opposite the bulkhead. The rivets which connect the bulkhead to the vessel's skin run in a zig-zag direction. T-irons are also used for the ship's frames or timbers where double angle-iron timbers are required. Fig. 3, is a section, taken at the bulkhead. In this case an ordinary T-iron is connected in the same manner to the skin-plates, by means of double countersunk rivets *d, d.* Fig. 4, is a section of the double-rivetted seam applicable to iron ship-building, boiler plates, and other purposes, showing a double countersink of or about three-fourths the thickness of the plates, leaving a portion of the rivet parallel in the middle. The head of the rivet is slightly curved, for the purpose of placing a tool thereon while the rivetting is being performed at the other end. Fig. 5, is a section of a single seam, showing the countersink continued the whole thickness of the plates, instead of being only three-fourths the thickness.

The patentee claims, "First,—the method of fixing and securing the bulkheads of iron ships, and otherwise strengthening the ship where the bulkheads are fixed, as described. Second,—the method of rivetting the plates of iron ships, boiler plates, and others, before described."

To JOHN HAMILTON, *of Glasgow, N.B., and* THOMAS SILVER, *of Philadelphia, U.S.A., for improvements in marine steam-engines.*—[Dated 15th February, 1860,]

THE chief object of this invention is to bring marine steam-engines more perfectly under control than hitherto.

The invention consists principally in causing a temporary "back pressure" in the cylinder, so as to retard the motion of the piston when there is a tendency to "race." This back pressure is obtained according to one plan by means of a throttle valve introduced between the cylinder and the condenser, and actuated or adjusted by hand, or placed in connection with a governor arranged to close it, on the proper speed being exceeded. In connection with this, the condenser injection cock may be placed in connection with a governor, to regulate the supply of injection water to the requirement of the condenser, and one or both of these arrangements may be used in concert with, or independently of, the ordinary steam pipe throttle valve. In constructing either the steam pipe throttle valve or that for the exhaust, it is preferred to give a bulged or expanded form to the passage on each side of the valve, in order that a very small turn of the valve from a transverse position may give a full passage to the steam. It is also preferred to make the injection of the balanced class, and with the last-mentioned improvement.

In Plate XI., fig. 1, is an elevation, and fig. 2, is a plan, partly in section, showing the regulating apparatus and as much of the engines to which it is applied as is necessary for explanation.

In this case the engines are supposed to consist of inverted cylinders A, driving the screw-propeller shaft as is usual with this class of engines. The valve casing C, is situated between the two cylinders A, and has communicating with it the steam pipe D, and the two branches of the exhaust pipe E, the latter leading to the condenser F. The steam pipe D, is fitted with a throttle valve *d*, and a throttle valve *e*, is also fitted to the exhaust pipe E. The levers by which the throttle valves *d* and *e*, are adjusted, are connected by links *g*, *h*, to levers G, H, on a shaft I, which, by means of another lever *i*, is actuated by the moveable sleeve J, of a governor. The parts acting upon the steam and exhaust throttle valves *d* and *e*, are so adjusted, that when the governor tends to close them, the latter valve *e*, will close sooner or to a comparatively greater extent than the former. In some cases, it is proposed that the governor should act only on the exhaust valve *e*, the intention being to retard the engine by back pressure rather than by diminishing the supply of steam. The apparatus will generally come into action when the propeller is lifted out of the water by the pitching of the vessel, and tends to "run away." This increase in speed will be prevented by the back pressure induced by the closing of the throttle valve *e*, whilst the full steam pressure will be retained upon the piston, ready to act the moment the propeller re-descends into the water and the governor reopens the throttle valve in consequence of the retarded motion. In this way less time will be lost in regaining the proper speed than when the steam throttle valve *d*, only is acted upon by the governor.

A throttle valve *k*, is shown as applied to the injection pipe K, by which the water enters the condenser F; the valve *k*, being also connected by a link *l*, to a lever L, on the shaft I, so as to be acted upon by the governor, for the purpose of modifying the supply of injection water simultaneously with the supply (or exhaust) of steam. This arrangement will prevent there being an extra quantity of water to remove from the condenser at times when it is desirable that the engine should give out its best effect.

The improvement in constructing the part of the passage or the short pipe casting in which the throttle valve is inserted, in the various cases hereinbefore detailed, is shown in section at fig. 2. The casting is of the general bore of the pipes or passages at the flanges, and at the middle part which the valve fits and fills when closed; but the portions of the casting between such middle part, and the flanges on each side, are bulged or widened out, so as to give a free passage to the steam or water with a comparatively small movement of the valve.

The patentees claim, "First,—the using or applying of a throttle valve, actuated by a governor, in the exhaust passages of marine engines, either alone or in combination with a throttle valve in the steam passages, substantially as described. Secondly,—the applying, in marine engines, of a valve, actuated by a governor, to the injection pipe, in combination with an exhaust throttle valve, or in combination with exhaust and steam throttle valves, substantially as described. Thirdly,—the constructing or shaping of the parts immediately adjacent to the throttle valve, substantially as described."

To THOMAS SILVER, *of Philadelphia, U.S.A., and* JOHN HAMILTON, *of Glasgow, N.B., for improvements in apparatus for governing or regulating the speed of steam and other engines and machines in motion.*—[Dated 25th February, 1860.]

THIS invention relates to a novel arrangement of machinery or apparatus intended to be employed for governing or regulating the speed of steam and other engines and machinery in motion, and it consists in mounting balls or other weights upon lever arms, so that they shall revolve around a central axis, the levers being at right angles to the central spindle, and free to vibrate tangentially; such vibration or motion being parallel to the plane of rotation or motion.

In Plate XI., fig. 1, is a side elevation, fig. 2, is a plan, and fig. 3, a transverse sectional elevation, of the governor-balls or weights when at rest. *a*, is the governor-shaft or spindle; *b*, the pulley, by means of which a connection is taken from the engine; *c*, *c*, are brackets for supporting the governor apparatus; *d*, *d*, are supporting arms or levers, keyed to, and rotating with, the governor-shaft or spindle *a*; *e*, *e*, are studs or guide-pins, projecting from the ends of the arms *d*, *d*; *f*, *f*, are segmental toothed wheels, each provided with a suitable boss, and free to rotate upon studs projecting from the enlargement formed for that purpose upon the governor-shaft or spindle *a*; *h*, *h*, are segmental toothed wheels and free to rotate upon the short spindles *e*, *e*, thus forming two pair of segmental toothed wheels in gear; *i*, *i*, are the governor-balls, secured to the ends of the arms *k*, *k*, these arms being secured to the back of the segmental toothed wheels *h*, *h* (as shown), and forming one with such wheels: *l*, *l*, is an intermediate central arm or lever, placed parallel with the levers *k*, *k*, carrying the governor-balls, and connected to such levers *k*, *k*, by means of the links *m*, *m*: by this arrangement, the possibility of damage to the teeth of either pairs of the segmental toothed wheels *f*, *f*, and *h*, *h*, is avoided. Each of the segmental toothed wheels *f*, *f*, are provided with a suitable stud or studs *n*, *n*, projecting from the upper part of the face of one wheel, and from the under or lower part of the face of the other. To these studs are attached the side connecting-links *o*, *o*, each of such side links being free to move upon suitable pins in the cross-head of the sliding socket or sleeve *p*. *q*, is the spiral spring, one extremity of which is attached to or pressed against the end of the sliding socket or sleeve, and at the other extremity against a regulating collar or the cross-arm *d*; *r*, is a stud projecting from the governor-shaft or spindle, and passing through a slot formed in the sliding socket or sleeve, as shown in figs. 1, and 2; *s*, is a forked lever, working in the grooved portion of the sliding socket or sleeve *p*, and to which lever is connected the rod *t*, for working the throttle valve.

If thought desirable, the intermediate lever *l*, *l*, to which the links *m*, *m*, are attached, may be dispensed with, and instead thereof, the ends of each of the levers *k*, *k*, (*i. e.*, the end of such levers opposite to that which carries the balls) may be lengthened, and the opposite extremities of such lever connected by means of suitable links.

In order to secure additional sensitiveness of action, a fly-wheel may be used in combination with this arrangement of governor, such fly-wheel having suitable guides or slots formed in its arms. In these guides work back and forth small friction-rollers, attached to the ends of the arms or

levers carrying the governor-balls, or to the intermediate links connecting such arms or levers; or studs may project from the face of the fly-wheel arm, and work in slots or guides formed in the levers or arms connecting the governor-balls.

The patentees claim, "the combination of balls, or weights of other suitable form, with lever arms, mounted, connected together, and working as herein set forth, having relation to a central shaft or axis, as hereinbefore described, and whether or not such novel arrangement and disposition of parts and mode of working be employed in combination with one or more re-acting springs, and with a fly-wheel, or either of them separately."

To Alphonse René Le Mire de Normandy, *of King's-road, Clapham-park, for improvements in obtaining fresh water from salt water.*—[Dated 27th March, 1860.]

This invention consists of improvements in aerating the steam supplied from a boiler under pressure, so as to condense it into aerated fresh water. The figure in Plate XII., is a vertical section of the improved apparatus. *a, a,* is a cylinder containing pipes *b, b,* in which the steam is condensed. The number and size of these pipes vary with the quantity of steam to be condensed; or they may be replaced by a worm. *c,* is a cap or chamber, into which the compressed steam is admitted; and *d,* is a lower cap or chamber, in which the condensed steam falls. *e,* is an air pipe, through which the air disengaged by the heat of the steam from the condensing water contained in the condenser *a, a,* passes into the chamber *c,* and mixes with the steam condensed in the pipes *b, b, b.* *f,* is a pipe, through which the aerated fresh water condensed in the chamber *d,* flows into the chambers or caps *g, g,* and through the refrigerating pipes *h, h,* of a refrigerator *i, i.* The number and size of these pipes *h, h,* are proportionate to the quantity of fresh water to be refrigerated. These pipes may also be replaced by a worm of a suitable size. Around the pipes *h, h,* the condensing salt water circulates. *j,* is a pipe, for the exit of the refrigerated and aerated fresh water; and *k,* a pipe, through which the cold water used for the refrigeration of the condensed aerated fresh water enters the refrigerator *i, i.* *l,* is a pipe, through which the refrigerating salt water passes from the refrigerator *i, i,* into the condenser *a, a*; and *m,* is a stand-up pipe, rising above the condenser for the purpose of keeping it full of salt water. When the apparatus is placed below the sea water level, the stand-up pipe is replaced by another communicating with the sea water, in which case the air pipe *e,* should be raised a few feet above the salt water level. *n,* is a pipe for the exit of the condensing salt water; *o,* water-gauge; *p,* steam pipe, through which the pressure steam is admitted into the apparatus.

The mode of working the apparatus is as follows:—Salt water being forced into the apparatus through the pipe *k,* the water will flow into the refrigerator *i, i,* and through the pipes *l,* and *m,* filling the condenser *a, a,* and escaping at the outlet *n.* If now steam under pressure be admitted at the steam pipe *p,* it will expand in the chamber *c,* and be condensed in the pipes *b, b*; but as the steam is admitted at the top of the condenser, the salt water soon becomes sufficiently hot there to part with the air

which it holds in solution, and which, passing through the air pipe *e*, will mix with the steam in the chamber *c*, and be condensed with it in the pipes *b*, whence it will pass in the state of aerated fresh water, by the pipe *f*, into the pipes *h*, *h*, of the refrigerator *i*, *i*, and thence escape at the exit pipe *j*. If, however, more steam is admitted than the pipes *b*, *b*, *b*, can condense, intimation of the fact is given by the salt water sinking in the water gauge *o*; and when this is observed, the quantity of steam admitted into the apparatus must be reduced by turning off more or less the cock of the pipe *p*, in communication with a steam-boiler.

The patentee claims, "any form of apparatus substantially the same as herein described, and whereby pressure steam may be condensed into aerated fresh water."

To Henry Martyn Clarke, *of Massachusetts, U.S.A., for a new and useful or improved machine for the making and sizing of pulp used in the manufacture of paper,—being a communication.*—[Dated 27th March, 1860.]

This invention consists in an improved pulp making and sizing engine or machine, having a conical grinder and outer grinding shell or case thereto, and pipes for the introduction of the rags and the size, and their subsequent eduction.

The figure in Plate XII., is a cross section of the improved apparatus for sizing pulp. *a*, is an outer conical grinding case, and *b*, is an inner conical frustrum or grinder, the latter being arranged within the former, and both being disposed with their common axis horizontal or thereabouts. The shaft b^1, of the grinder *b*, is supported in suitable bearings *c*, *c*, and passes through stuffing boxes *m*, *m*, applied to the two heads of the case *a*. This shaft is provided with adjusting screws *d*, *d*, so applied as to enable it to be moved either longitudinally or transversely, as occasion may require, in order to effect the proper adjustment of the grinder *b*, within its case, either for fine or coarse grinding, or otherwise. The external surface of the grinder *b*, as well as the internal surface of its case, is provided with ranges of teeth or cutters, by which, while the grinder may be revolving within the case, they may cause any rags, when in the latter, to be properly reduced. A driving pulley *f*, is fixed to the shaft of the grinder *b*. The case *a*, is furnished with two induction pipes *g*, *i*, and one eduction pipe *h*,—they being arranged with reference to the ends of the grinder as shown. The rags are fed into the case through the conduct *g*, the sizing being allowed to flow into the pipe *i*, and from thence into the case. After the rags have been properly reduced and mixed with the sizing, the pulpy mass is discharged through the eduction pipe *h*. By the peculiar arrangement of the pulp and size induction pipes *g*, *i*, the sizing is not introduced into the pulp until the latter is nearly, if not entirely, reduced to the fineness that may be required. By being introduced into the upper part of the case, the sizing will be thoroughly mixed with the pulp before it is discharged at the pipe *h*.

The reduction of the rags first takes place near the smaller end of the rotary grinder, the ground rags being finally discharged under the said grinder and near to its larger end; the construction and arrangement of the grinder being such as to enable gravitation to operate in effecting the

passage of the pulp from the induction pipe at one end of the case to the eduction pipe at the opposite end thereof.

The patentee claims, "the improved pulp-making and sizing machine as constructed substantially in manner, and so as to operate, as described."

To EDWARD MUCKLOW, *of Bury, Lancashire, for certain improvements in the treatment of madder roots, munjeet, or other plants of a similar class.*—[Dated 24th February, 1860.]

THIS invention relates to a peculiar treatment of madder roots, munjeet, and plants of a similar class, whereby they are cleansed more effectually than hitherto from such impurities as would otherwise mask or interfere with the color or dyeing properties of the roots.

The improved treatment consists in submitting the madder roots, munjeet, &c., to the following process preparatory and prior to their being ground or pulverized, in contradistinction to grinding or pulverizing them first and then submitting them to the same or a similar process, by which latter method the impurities become ground together with the roots, rendering their thorough separation after such grinding almost impossible:—The madder roots are steeped in pure cold water, or the water that may be slightly impregnated with any neutral salt or earthy or other matters not having the properties of dissolving or acting as a solvent upon the coloring principle contained in the roots, or they may be saturated and treated in various ways by pressure and vacuum; the object being to effect the thorough saturation of the roots, which may take, according to the means used and the quality of the roots, say, from one to six hours. In countries where the roots are grown, the saturation may be unnecessary. The roots are to be taken and subjected to severe hydraulic or other pressure, by which means mucilaginous, saccharine, and other organic substances are in part expelled in the state of solubility, and the pressure increased and repeated as often as found necessary: by this simple means, the roots containing the coloring matter and undissolved fibres are partially freed from the said matters. The roots are then to be removed from the press, dried and ground, in which state the patentee terms the product refined madder: in this state, it will be found that (not having been treated with acids or alkali) the improved refined madder will answer every purpose, and become an economical substitute for what is now termed "finest ground madder." Madder, thus refined, will not stain, to so great an extent, the unmordanted or white portions of the fabrics to be dyed; and for the purpose of dyeing Turkey red, as also printed fabrics, it will also greatly economise the use of soap and other alkalies in clearing and producing the finer shades of colors printed on cotton, linen, or silk fabrics. The refined madder will also be valuable in the manufacture of garancine, alizarine, or other madder extracts, and for such purpose will greatly economise the use of acids or alkalies in such preparations.

The mucilaginous, saccharine, and other organic impurities expressed from the roots are equally available for fermentation and distillation as if taken from the ground madder, and any of the coloring matter which may be expelled with the impurities may be recovered by precipitating it with fresh or waste mineral acids.

The patentee claims, "freeing madder roots, munjeet, and plants of a

similar class, from the impurities they contain, by the above mode of treatment, and by submitting them to severe pressure when in a moist state, and previously to their being dried, and cut, ground, or pulverized; by which means the said impurities or extraneous matters are more readily and effectually separated from the roots than by adopting the means ordinarily employed."

To CONRAD WETTER, *of Myddleton-square, for improvements in the manufacture of fermented and spirituous liquors.*—[Dated 24th February, 1860.]

THIS invention relates to the use of the cane or plant known as "sorgho," "sorko," or "sorco," from which extracts worts and wash are produced, and the same converted, by ordinary processes, into wine, beer, ale, vinegar, and other fermented liquors and spirits. The juice of the sorgho may be set to ferment either with or without yeast, as it contains naturally sufficient ferment to excite the vinous fermention. The cane may also be crushed, and the crushed cane fermented in its own juice, diluted or not diluted with water, or with or without other ferment exciting drugs.

For the production of spirits, when the fermentation is finished, the fermented juice is submitted to distillation, to separate the spirit from the dross. Aromas, or flavoring ingredients or rectifying ingredients, may be added to the juice before and after the fermentation, or the spirit may be rectified, and then the aromas added.

For the making of wine, the juice of the sorgho is set to ferment with or without tartar and tartaric acid, according to the predilection of the manufacturer, with any flavor, at pleasure. When the fermentation has ceased, the fermented liquor is drawn clear off from the sediment, and preserved in the ordinary manner in a cool cellar.

When making beer, the sorgho juice is boiled two hours with hops, at the rate of one pound per barrel of thirty-six gallons, cooled down to a temperature of from 80° to 90° Fahr. in winter, or from 70° to 75° in summer, when yeast is added to set it to ferment; after which it is drawn off clear into casks in a cool cellar, and a handful of hops added to each puncheon.

In order to make vinegar, the fermented sorgho juice is then drawn off clear from its sediment, and placed in upright casks, with air-holes above the surface of the fermented juice, and four gallons of real vinegar added to 100 gallons of fermented juice at a temperature of 97° Fahr.; and the air in the room must be kept at the same temperature, and impregnated with vinegar fumes. The acetous fermentation being thus excited in the fermented juice, will convert it into vinegar, which is then drawn off clear, and kept in a cool cellar.

The color of the spirits, beer, wine, and vinegar, is prepared by heating the fresh juice over a fire till it assumes the consistency and color of a very thick dark brown treacle; hot water is then added, and ebullition continued until all is dissolved. It is then called "caramel," similar to burnt sugar coloring.

The patentee claims, "the application of the sorgho and its varieties for the production, by fermentation, of spirits, beer, wine, and vinegar."

To JAMES HOWARD, *of Bedford, and* JOHN LILLEY, *of Ashwood, Buckinghamshire, for an improved construction of horse-hoe.*—[Dated 9th May, 1860.]

THIS invention relates to the adaptation to lever horse-hoes of the principle of steerage already adopted in horse-hoes where a set of hoes is fixed to a common carrying bar; the object being to simplify the construction and increase the efficiency of the lever horse-hoe. To this end the construction of the implement is modified, as shown in Plate XI., wherein fig. 1, is a back view of the improved horse-hoe, and fig. 2, is a longitudinal section of the same. *a, a,* represent the frame of the implement, through the lower bar of which a centre-pin or screw-bolt *b,* passes. This pin, by means of a shackle-piece *c,* formed with lugs to embrace it, carries the steering handles *d,* which are capable of receiving a vertical rocking motion on the pin that couples them to the shackle, and also a horizontal motion, by the shackle turning on the centre pin *b.* The handles are formed of two flat bars, which lie parallel with each other for a given distance, until they branch off like horns, to form the forked handles proper, like the ordinary steering handles of horse-hoes. At the point where these horns branch off, a socket-piece *e,* is inserted between the bars that form the handles, and secured by a cross-bolt. This socket *e,* carries a swing-bar *f,* to the ends of which are secured pendent brackets. To these brackets a horizontal jointed or compound bar *g,* is attached by pins. This bar is pierced with holes along its whole length, to receive pins for securing a series of links *h, h,* thereto, and these links serve to support the hinder ends of the hoe levers *i, i, i,* which are grouped together in couples by short bars *k, k,* to which they are secured by pendent links k^1. The forward ends of the several levers *i, i, i,* are jointed and secured to the slotted lever-bar *l,* in the usual manner, which lever-bar is supported by a pair of wheels *m, m,* made adjustable by means of their stalks, for the purpose of regulating the dip of the hoes into the ground. In other respects, the implement is similar to lever horse-hoes of the ordinary construction. *n,* is the lever handle for lifting the hoes off the ground: it is hinged, as usual, to bracket-arms, and connected by a coupling-chain to the socket-piece *e,* and, when depressed, will lift the steering handle, together with the hoes which are pendent therefrom. By coupling the forward end of the lever handle *n,* to the steering handle by a catch *o,* the hoes will remain in suspension; thereby enabling the instrument to be removed from place to place without the hoes coming in contact with the ground.

When the implement is in use, the attendant steers it by means of the handles *d,* and when requisite to pass any obstacle in their path, he can, by their means, suddenly lift the hoes out of the ground. The peculiar connection of the hoes with the handles *d,* allows also of the attendant putting a temporary pressure upon the hoes when they meet with obstruction from the hardness of the ground, which cannot at present be done in lever horse-hoes; the pressure depending upon the dead weight distributed over the levers.

The patentees claim, "the arrangement, above described, for effecting the steerage of lever horse-hoes."

To Alexander Melville, *of George-street, Portman-square, for improvements in the preparation and manufacture of compounds for marking on paper and other fabrics and substances.*—[Dated 27th February, 1860.]

This invention consists of certain improved methods of preparing and manufacturing compounds to be employed for writing, drawing, and marking on paper and other fabrics and substances; the markings thereby produced being of an indelible character, and irremoveable by ordinary re-agents.

The patentee, in describing the constitution of the compounds forming the subject of the invention, for the purpose of convenience and reference, distinguishes the several processes by numbers.

Process No. 1.—Plumbago or other carbonaceous matter is intimately mixed with one or more of the following substances, that is to say, wax, spermaceti, tar, pitch, bitumen, resins, and gums, or with oils or other fatty matters, or the component parts thereof, or soap; a proportion of sulphate of alumina (common alum) or other substance capable of rendering such of the before-mentioned materials as have an affinity for moisture insoluble in water, being added to the composition thus formed. Any suitable coloring or staining substance or substances may also be introduced into the before-described composition.

The following proportions may be given as an example of this process:—Gum cowrie, 15 parts; tallow soap, 17 parts; alum or proto-nitrate of iron or other metallic salt, 3 parts; coal bitumen (coal tar pitch), 4 parts; vegetable black, 6 parts.

These substances are mixed and fused together at a high temperature, and are manufactured into the required form while at a sufficient temperature to be of the consistence of stiff paste or dough.

Process No. 2.—Plumbago or other carbonaceous material, and steatite, kaolin, pipe-clay, or any one or more of the various earthy substances, such as are used in the manufacture of ordinary marking or drawing crayons, are mixed with one or more of the salts or oxides of metals, and ground with water or alcohol, or some other of the fluids included in the denomination of hydrocarbons, to the consistence of paste, the same being afterwards manufactured into the desired forms, and then dried by the application of heat until sufficiently hard for use; the degree of heat proper for the purpose varying according to the proportions of the several substances and the purposes for which the composition is to be used. The composition having been thus made and formed into shape, the same is then saturated with oil or fatty matter containing coloring or staining principles, such as are contained in bitumen or such other substances as impart their color to oily or fatty substances or compounds.

The following is an example of the proportions employed in the manufacture of the compounds under this division:—

Fullers' earth, 8 parts; fine plaster of Paris or kaolin, 8 parts; plumbago, 8 parts; vegetable black, 8 parts; gum acacia, 1 part. And for saturation, as before mentioned,—Tallow, 3 parts; bitumen of Judea, or other mineral pitch, or coal-tar pitch, 1 part.

Process No. 3.—Fullers' earth is combined with wax, spermaceti, oils, tallow, or other fatty substances, or the component parts thereof, so as to render the same capable of liquefaction or miscible with water or alcohol,

or other fluids included in the denomination of hydrocarbons. The compound thus formed is then incorporated with plumbago or other carbonaceous matter, or with any suitable substance or substances, such as the salts of metals, gallic acid, tannic acid, or resinous gums, and such substances as contain staining and dyeing properties or principles; the same being then intimately mixed and ground with water to the consistence of a stiff paste or dough, and then manufactured into the required form, and dried.

The patentee claims, "the several compounds for writing, drawing, and marking on paper and other fabrics and substances, as described, or any mere modifications thereof."

To Laurent Marie Boulard, *of Paris, for improved apparatus for preventing or destroying incrustations in steam-boilers.*—[Dated 14th April, 1860.]

This invention consists in the substitution of a mechanical arrangement for the chemical re-agents at present in general use for the prevention of calcareous deposits in steam-boilers, or their destruction when formed. This arrangement is composed of a case or bag of pierced sheet metal, metallic gauze, or even non-metallic tissue, corresponding in shape with the boiler in which it is enclosed, and forming, as it were, an open-worked lining, kept at a slight distance from the inner surfaces by means of brackets. If so required, this lining, the meshes or perforations of which should be finer at the bottom than at the top, may be made in several sections, which are passed separately into the boiler by the man-hole, and afterwards connected in any suitable way. In many cases, the metallic or other tissue may be replaced by a simple recipient of sheet metal, or even non-metallic material without perforations, inserted in the boiler, and secured by brackets, as above. In this case, the apparatus, instead of being completely tubular, should be of a gutter form, open at the top, the ends being either left open or closed with pierced metal or gauze. Or the same results may be obtained by the insertion in the boiler of any required number of wire-gauze or other perforated shelves, superposed at equal distances, and so arranged as to be easily withdrawn from time to time for the removal of the calcareous matters deposited.

This apparatus has the property, not only of preventing deposits on the inner surfaces of the boilers to which it is applied, but also of removing such deposits from boilers already fouled. In the one case, the calcareous matters precipitate in the open lining, by which they are entirely isolated, and from which they may easily be removed from time to time. In the other, the incrustations already formed, detach spontaneously from the surfaces of the boiler, and, falling to the bottom, may be cleared away without further trouble.

The patentee claims, "the substitution of a mechanical arrangement, substantially as above described, to the chemical re-agents hitherto generally employed for the prevention or destruction of calcareous deposits or incrustations on the inner surfaces of steam-boilers."

To Sir John Scott Lillie, C.B., *of Pall Mall, for improvements in carriage ways.*—[Dated 14th April, 1860.]

This invention consists in cementing small stones together, and casting them in moulds of a convenient size, and of an equilateral or quadrilateral shape, so as to admit (when formed into such blocks) of their being laid on streets, and having three additional surfaces to be presented to the traffic when repairs are necessary; also in introducing between such blocks alternate rows of wooden blocks, as well as between solid stone blocks, for the purpose of diminishing the noise arising from the traffic. This combination of wood and stone may be carried into effect on roads or streets without rendering it necessary to have the above material cast into blocks. The wood is made impervious to water by impregnating it with bituminous, oleaginous, or other such like fluids. The foundation on which the materials are to be laid, is formed into inclined planes, gently rising from the sides of the street or roads towards the centre, instead of being of a convex form as heretofore.

The patentee claims, "Firstly,—the combination of wood and stone, by having wooden blocks placed in alternate rows between the quadrilateral or equilateral blocks formed as described. Secondly,—placing alternate rows of wooden blocks on streets or roads between blocks of solid stone, or placing such blocks of small stones on roads or streets without being cast into blocks. Thirdly,—rendering the wood thus employed impervious to water as described. Fourthly,—forming the foundations for such surfaces in the manner described. And, Lastly,—the forming of carriage ways for streets and roads, by a combination of materials in the manner described, for the purposes set forth."

To William Smith, *of Kennington-row, Kennington-park, for improvements in paving or covering roads and other ways.*—[Dated 16th April, 1860.]

This invention relates to the use of wood, in combination with stone, in forming paving or covering to roads and other ways. The wood and stone are formed in blocks of the sizes and forms desired, and may be combined in various ways. One combination consists in laying the wood blocks and the stone blocks in alternate lines, such lines ranging transversely, or they may be in other angles across the road or other way, so that the traffic passing along such road will thus act alternately on such wood and stone. In place, however, of arranging the differently-composed blocks in continuous lines, they may be arranged in zig-zag or other forms, and the alternations may be in combined longitudinal and transverse directions. The object will, in all cases, be so to combine the wood and stone that the respective blocks may be in rows, or otherwise alternate as much as possible.

In carrying out these improvements, the road is first prepared by a bed of concrete in the usual way, and, as is well understood, the wood is kyanized, or otherwise treated, to give increased durability to the same.

By the combination of wood and stone in the formation of roads or other ways, several advantages are obtained—viz., economy in construction over the use of stone alone, by the wood being cheaper than the

stone; also, reduction of noise produced by the passing traffic, whilst the combination of the stone with wood affords a safer holding for the horse's feet than when a road or way is wholly formed of wood.

To JULES FERDINAND HILLEL, *of Mark-lane, for improvements in the apparatus, and in the mode of treating Spanish grass and other fibrous materials, to be used in the manufacture of paper pulp.*—[Dated 11th April, 1860.]

THIS invention has for its object an improved method of treating the *Halpha Esparte* or Spanish grass, rushes, and other similar textile fibrous plants, in order to produce therefrom paper pulp. To this end, the heel or other knotty portion of the plant is first removed by means of a sharp blade or of a circular saw, so framed and mounted as to separate the same from the rest of the plant. The fibre is then placed in an apparatus suitable for successively steeping, boiling, and steaming the same,—the latter operation being effected either with ordinary or superheated steam, and the steeping and boiling being performed with a solution of caustic alkaline salts of a suitable strength; the object being to soften the plants, and to cause them to swell, thus preparing them for the purpose of separating their fibres. This operation is effected by any machine which will reduce them to the fineness required. The fibres are next treated with an alkaline solution of a suitable strength, in combination with other solvents, until all their gummy and resinous substances are dissolved; they are then well washed, and ready to be bleached, which latter operation is performed as follows:—Instead of using a solution of the ordinary chloride of lime from powder, a solution is prepared by introducing a stream of washed chlorine gas into a vessel containing water, which holds in suspension an adequate quantity of hydrate of lime or other alkaline hydrate in solution, and the strength of this mixture is regulated as may be required, by which means a great economy is obtained, and purity and uniformity of results secured. In bleaching some materials, the patentee adds a small quantity of ammonia or some ammoniacal salts, so as to obtain a purer color. In order to produce a more powerful agitation and intermixture in the bleaching vat, a movement, compounded of a horizontal and vertical motion, is given to the mass, by driving from the main shaft which supports and gives motion to the ordinary horizontal agitators, two other shafts parallel to the former, and having agitators at right angles. These shafts have a motion of rotation both on their own axes, and also round the main shaft and its agitators, both of which motions may vary in direction from the latter. After the bleached materials have been well washed, when they are of a nature to require it, they are treated with bran water at a moderate temperature, whereby all traces of chlorine are removed, and the fibres become softer and better adapted for the purpose of paper-making. In order to dry the pulp, after expressing as much water out of it as possible, currents of hot air are passed through the mass from the surface downwards, in contradistinction to the ordinary method of passing it upwards; and by thus causing it to follow the natural course of the heavier fluid, the moisture is rapidly separated from the pulp.

The patentee claims, "the process and method of treating Spanish grass or other such fibrous plants, in order to produce therefrom pulp from paper, as set forth."

To JOHN WEBB, *of St. Austell, Cornwall, for improvements in the cartridges employed in blasting.*—[Dated 12th April, 1860.]

THIS invention consists in using for the tube or case of the cartridge cloth made waterproof by any well-known method, the seams and joinings of the same being also made waterproof by means of any suitable cement, and in providing at the junction of the fuse and cartridge a material which will not take fire and smoulder in the event of the direct fire from the fuse not reaching the charge in the cartridge.

Instead of employing, as is usual for the cartridge, a case made of paper, which is liable to be destroyed or damaged by the force employed in placing it in the bore hole, or by the action of water, where the hole is wet, and thus allowing the charge of gunpowder contained therein to be spoiled or damaged, the patentee uses thin cloth made waterproof by means of boiled linseed oil, solution of india-rubber, gutta-percha, or other suitable material, and cements the junctions at the side and one end of the same by means of such cement, leaving the other end open to receive the charge of gunpowder, and then to be tied tight round the fuse, so as to produce a cylindrical bag or case proportioned to the diameter of the bore-hole, and of a length sufficient to contain the necessary quantity of gunpowder.

A bunch of cow hair, flannel, or other similar loose woollen material is used as a wadding between the tamping and the charge, and which is most conveniently and efficiently arranged by being bound round or attached to the fuse immediately adjoining the case or cartridge; this provision effectually prevents (in the event of the fuse being defective) the fire from the fuse smouldering, and at a long interval reaching the charge in the cartridge, and thus producing accidents; the effect of the woollen material being to smother and extinguish any fire still smouldering in the damaged fuse, and thus to prevent its reaching the charge, except by the direct action of the powder in the fuse.

The patentee claims, "the employment of a waterproof texile material for the tubes or cases of cartridges employed to contain the charge of gunpowder used in blasting operations, and the employment of a tuft of cow hair, wool, feathers, loose woollen fabric, or like substance, as a wadding between the cartridge and tamping."

To JOHN DALE *and* HEINRICH CARO, *both of Manchester, for improvements in dyeing cotton yarns or threads and fabrics,—being a communication.*—[Dated 19th April, 1860.]

THIS invention consists in dyeing cotton yarns or threads and fabrics by treating them with a solution containing the necessary mordaunts and the coloring matter combined together, and subsequently with a substance which will precipitate the necessary material for constituting the dye.

In carrying out the invention, two different preparations are employed.

The coloring principles of logwood, fustic, bark, catechue, sapan-wood, or shumach, either by themselves, or as mixtures of two or more of them, are dissolved in a suitable quantity of water, together with metallic salts or mordaunts, as salts of iron, alumina, tin, copper, &c., either alone or as mixtures of two or more of them, and these mixtures of coloring matter and metallic salts are kept in solution, or in a state fit for dyeing by combining them with gums, gum substitutes, sugar, or analogous organic matters, together with mineral or organic acids: this constitutes the first preparation, through which the goods are passed in any usual manner most suitable to them, an ordinary padding machine being by preference employed. By whatever process this be done, it is essential that all excess of the first preparation be removed by squeezing or other means. This having been effected, a second preparation is used, which has for its object the development and complete precipitation of the color to be produced. This preparation consists of a solution of free alkali, as caustic soda, potash, ammonia, or lime, or alkaline carbonates, phosphates, arseniates, acetates, tartrates, silicates, stannates, aluminates, together, when required (as in procducing blacks), with oxidizing agents, as neutral or acid chromates of the alkalies.

By way of illustrating the improved process, the following examples are given:—

Black to Dye 10 *lbs. of Cotton.*

First preparation.—Four gallons of logwood extract, 5° Tw.; one gallon of fustic, 5° Tw.; one pound of gum senegal, half a pound of molasses; dissolve and mix by degrees with six pounds of nitrate of iron, 42° Tw., previously mixed with three-quarters of a pound of oxalic acid, and half a pound of alum.

Second preparation.—One and a half gallon of neutral chromate of potash, of 7° Tw. The black is formed immediately in the goods, and after two or three hours they are ready for washing off.

Crimson for 10 *lbs. of Cotton.*

First preparation.—Five gallons of extract of sapan, 2° Tw., one pound of gum senegal, half a pound of sugar; dissolve and mix with two pounds of alum half a pound of oxalic acid.

Second preparation.—One gallon and a half of neutral aluminate of potash, 1° Tw.

Blue for 10 *lbs. of Cotton.*

First preparation.—Five gallons extract of logwood, 2° Tw., one pound of gum arabic, half-a-pound of sugar; dissolve and mix with two pounds of alum half-a-pound of oxalic acid.

Second preparation.—One gallon and a half of neutral aluminate of potash, 2° Tw., quarter pound of neutral chromate of soda.

Yellow for 10 *lbs. of Cotton.*

First preparation.—Five gallons of bark liquor, 3° Tw., one pound of gum-arabic, half pound of sugar; mix with two pounds of alum half-a-pound of oxalic acid.

Second preparation.—One and a half gallon of neutral aluminate of soda, 2° Tw.

The patentee claims, "the dyeing of cotton yarns or threads and fabrics, by treating them firstly with a solution containing coloring matter

and mordaunts combined, and subsequently with a solution which develops or precipitates the color. Also the use of gums, sugars, or analogous organic matters and acids, or one of them, in combination with the first preparation above described."

To Thomas Geast Dawes, *of Wolverhampton, for improvements in working hammers by compressed air.*—[Dated 20th April, 1860.]

In working hammers by compressed air according to this invention, the patentee constructs two cylinders, which are connected together at the bottom by a passage. The cylinder to which, or to the piston-rod of which the hammer is affixed, is called the hammer cylinder, and the other is called the motor cylinder. The motor cylinder should be of greater diameter than the hammer cylinder; but the hammer cylinder should be longer than the motor cylinder. If, for example, the hammer cylinder be double the length of the motor, then the motor cylinder should be five times the area of the hammer cylinder, if closed at top. Both cylinders are fitted with pistons and piston-rods. The piston-rod of the hammer cylinder passes through a stuffing-box, at the bottom of the cylinder, and to the said piston-rod is attached the hammer. The piston-rod of the motor cylinder may pass either through the top or bottom of its cylinder and such piston-rod is actuated by a crank or other mechanical contrivance, to which motion is given by steam or other power. The motor cylinder is generally open at top, but, if required, it may be closed at top and open at bottom; in that case a passage at the top of the motor cylinder is connected with the passage at the bottom of the hammer cylinder; or the motor cylinder may be closed both at top and bottom, by which means two hammers may be worked by one motor cylinder, by connecting its top and bottom passages respectively with the bottom passages of two hammer cylinders. Inlet and outlet valves are affixed to either top or bottom of the motor cylinder, as required, or to both when both are closed. The top of the hammer cylinder may either be open or closed, as required; if closed, inlet and outlet valves are affixed to restore the equilibrium of the air, if through leakage, or otherwise, this should be required. Or an air receiver may be fitted to the top, in which case the valves are connected with the receiver. An outlet valve is also connected with the bottom of the hammer cylinder, which will regulate the blow of the hammer, or stop it altogether. But as there is alternately compressed air both above and below the hammer piston, there is no tendency to disturb the equilibrium of air, for if in one stroke it escape from one side of the piston to the other, it will in the next stroke escape back again. Supposing the two cylinders to be perpendicular (one or both may be placed in any position or at any angle required), and the piston of the motor cylinder at the top, and the piston of the hammer cylinder at the bottom of their respective cylinders, then the descent of the motor piston causes the hammer piston to rise, and with it the hammer, and *vice versâ*, and either compress the air in the upper part of the hammer cylinder or not, as required. It is sometimes desirable to make the hammer strike with blows gradually increasing or decreasing in force. This may be effected in the following manner:—A hollow ball is fixed on the end of the lever of the outlet valve, at the bottom of the hammer cylinder, and floated on water; the water is allowed slowly to escape from the

vessel, and as the water sinks, the valve will be either opened or closed gradually, and so cause the hammer to strike a different blow each time. The inlet valves may be made self-acting or not, as required. The outlet valves may be opened by hand or by mechanism. The hammer cylinder (to the bottom of which is fixed the hammer) is worked by means of a hollow fixed piston-rod connected with the bottom of the motor cylinder. The same modifications as to the closed top or bottom of cylinder, are as applicable to this form of hammer as to the one hereinbefore described. The said hollow fixed piston-rod has an opening between the top of the hammer cylinder and the fixed piston. In this arrangement the hammer cylinder is closed at top, and either partly open at bottom or closed; if closed, a tube is introduced down the hollow piston-rod connected with the under side of the fixed piston; and to the top of the said tube, or connected with it, are attached inlet and outlet valves, to regulate the admission or expulsion of air to the lower side of the fixed piston, as required.

By another modification of the invention, a small blowing tube is substituted for the motor cylinder, and by suitable inlet and outlet valves at the top and bottom of the cylinder, condensed air is forced into a receiver, until, by means of a safety valve, sufficient pressure is obtained. The receiver is connected with the blowing tube by passages at top and bottom, and to the hammer cylinder by a passage at the bottom; this passage has a suitable valve. There is also another outlet passage with an escape valve at the bottom of the cylinder, one valve only being open at a time. These valves are opened and closed by any convenient mechanical contrivance as quick as the stroke is required, the receiver being supplied at the same time with the compressed air. The escape valve is connected with a tube which passes into a chimney or other artificial draught to draw out the air.

The patentee claims "the several arrangements or combinations of parts described for working hammers by compressed air."

To JOHN MCCULLOCH, *of San Francisco, U.S.A., for improvements in the reduction of gold, silver, and copper ores.*—[Dated 1st March, 1860.]

THE object of this invention is to operate upon the ores containing gold, silver, and copper, or mixtures of these ores and metals, in a more simple and economical manner than heretofore, for the purpose of obtaining the metal or metals therefrom in a metallic or reduced state. To this end the ore is first reduced to powder by stampers or other suitable means; and if need be, the metalliferous ingredients are concentrated by separating the constituent earthy compounds from the metallic compounds by washing and subsidence. With the ore, so prepared, there is intimately mixed a powdered charcoal, either animal or vegetable, or any suitable substance containing carbon, such as oils and fats; and to this may be added, if necessary, any refuse vegetable matter, such as sawdust, dry leaves, or grasses, chopped straw, or the excrementitious matter of herbivorous animals; and this mixture is moulded into such forms as will best admit of the application of fire heat thereto for the reduction or recovery of the metal or metals contained therein. But in order to give a sufficient amount of consistency and resistant strength to the moulded blocks or masses to allow of their being stacked in kilns, clamps, or ovens, and

ensure their retaining their shape while being exposed to a high temperature, a suitable proportion of clay or other equivalent binding material is worked into this mixture by the aid of a pug-mill,—water being added, as may be required, to facilitate the working. When the materials are thoroughly mixed, they are to be moulded into form, either by means of machinery or by hand moulds, and the blocks, bricks, or cakes, thus formed, are dried previously to being subjected to artificial heat.

The ores upon which the patentee proposes chiefly to operate are auriferous iron and arsenical pyrites, and the sulphides, sulphates, chlorides, carbonates, and oxides of silver and copper. Having reduced, say, any one of these ores to powder and worked it into blocks in admixture with the carbonaceous and plastic materials, as above explained, he stacks the blocks either in a kiln, made after the manner of a brick-kiln, or in a clamp or oven, preferring, however, the former, and fires them as when burning ordinary bricks. After the burning, the contents of the kiln, clamp, or oven, as the case may be, are allowed to cool down, and when cold, the burnt bricks or blocks are removed and reduced to powder. The gold and silver, separately or mixed, will be found in a comminuted metallic state, scattered through the mass, while the copper may be likewise in a metallic state, or it may be as an oxide, or a mixture of both, similarly scattered through the earthy matters of which the crushed blocks were mainly composed; and the same may then be readily separated from the mass by lixiviation, or (in the case of gold or silver) by amalgamation with mercury. The proportions of materials found to yield good results when manufactured into blocks and submitted to kiln, clamp, or oven burning, are—ground ore 100 parts by weight; charcoal 25; sawdust or other vegetable matter 50; and dry clay 50.

When burning blocks or bricks containing sulphide of silver, the woody and other carbonaceous matter mixed therewith will, by its partial combustion, render the masses porous, and thus afford a means for the oxygen of the air to penetrate through every part of the blocks, where, meeting with the sulphur liberated from the ore by the action of the furnace heat, it will form sulphurous acid, and thus carry off the sulphur in a gaseous form, leaving the silver in a metallic state imprisoned in the blocks with an ore of carbonate of copper. The combustion of the woody matter and charcoal, when the same is combined in a block, not only renders the block porous, whereby the carbonic acid of the ore set free by the heat is allowed to escape, leaving the metal as oxide of copper, but the carbon still present in the block, by commixture with the ground ore, to a great extent, takes the oxygen from the oxides of copper, leaving such portions of the copper in a metallic state.

It will thus be seen, that the carbonaceous matters, as applied for the liberation of gold, and the reduction and separation of silver and copper from their ores, has a materially different and far more efficient action than when simply applied in the manner commonly practised in the reduction of metals. And further, it will be understood, that as the clay acts merely as a medium for holding the comminuted particles together, other substances possessing the same property may doubtless be substituted for that material.

The patentee claims, "subjecting the ores of gold, silver, and copper, to kiln, clamp, or oven burning, when moulded or wrought into iron blocks, slabs, or masses, as above described."

Scientific Notices.

INSTITUTION OF CIVIL ENGINEERS.

November 13, 1860.

GEORGE P. BIDDER, Esq., President, in the Chair.

Before commencing the ordinary business, the President reminded the assembled members, that at the opening of the last session they had heard from the then President, Mr. Locke, a most feeling address announcing the decease of those two distinguished members of the profession, Mr. Brunel and Mr. Robert Stephenson. How little was it imagined, that the lips which then uttered the fervent eulogy upon the memories of his departed friends, would so soon be hushed in the silence of the grave. Another of the leaders had passed away, cut off in the prime of life, and in the full vigour of his intellect. In Mr. Locke, the profession had lost one of its most eminent members, and the Institution one of the ablest Presidents that had occupied that distinguished position. Sprung originally from that great nursery of practical engineers, the works at Newcastle-on-Tyne, Mr. Locke acquired there his mechanical knowledge and his unbounded confidence in the power of the locomotive engine. He was soon transplanted, to co-operate with the late Mr. George Stephenson in several of his early works, and nearly at the commencement of the construction of the Grand Junction Railway, the separation occurred into the causes of which it was as unnecessary as it would be invidious to enter. This separation between the master and pupil occasioned painful feelings at the time, but it must now be looked upon as an inevitable necessity, for the more rapid development of the railway system, at the period when the existing modes of transit had become totally inadequate for the requirements of commerce, and for the growing wants of civilisation. It had always been observed, that whenever the necessities of society required any peculiar development of talent, or any particular invention, by the interposition of an all-wise Providence, the man and the knowledge were forthcoming to provide for the growing wants of society. On the introduction of railways, it was requisite that a vast amount of mental energy and of physical exertion should be employed, in order to render the development as rapid as possible. Mr. Locke possessed peculiar qualities of mind, which secured for him the confidence of capitalists, by whom the construction of the Grand Junction Railway was entrusted to him.

At an early period of the railway epoch he became the engineer of the South-Western Line, whence he almost naturally sought for, and ultimately accomplished, the extension of the system to France, where, in the construction of the Paris and Rouen, and Rouen and Havre lines, he introduced English capital, English workmen, and English contractors, and initiated the Continental railway system. He was thus the first who promoted the establishment of the present rapid communication between the great commercial capital of Great Britain and Paris, the fashionable metropolis of the Continent.

Returning to the field of his early labors, he undertook the extension of the lines from Preston to Carlisle, and thence to Glasgow, Edinburgh, and, ultimately, to Aberdeen, thus becoming also the pioneer of the Scotch railway system.

Without entering minutely into the details of his professional life, which would be given in the official memoir, it would be admitted, from what had been stated, that Mr. Locke was entitled to be considered one of the great engineers of the period, and a distinguished pioneer in the introduction of the railway system.

There was a curious coincidence in the circumstances of the decease of the three distinguished men who had been removed within little more than a year. Each one had departed on the eve of, or at the completion of, some great work. Mr. Brunel might be said to have died as the "Great Eastern" steamer commenced its trial voyage; Mr. Robert Stephenson was taken away on the eve of the completion of the great Victoria Bridge over the river St. Lawence, Canada; and Mr. Locke's decease occurred on the completion of his long-cherished project—the extension of the narrow-gauge line to Exeter, the capital of the West of England.

Those who had watched the career of Mr. Locke were well aware how pertinaciously he adhered to the principle of making financial results the exponent of the success or failure of engineering projects. It was not that he feared engineering difficulties, for when they were inevitable he encountered and overcome them with skill; as, for instance, in the Works of the Manchester and Sheffield Railway. But his great anxiety—and which secured for him the confidence of a large body of capitalists—was to attain his object by avoiding difficult and expensive works, from a desire that all the works on which he engaged should be commercially successful. The abnegation of professional renown, arising from the construction of monumental works, whilst establishing his reputation as an economical engineer, induced him to turn to the locomotive engine, and to tax its powers (in which he had, from the earliest period, the greatest confidence), for overcoming steeper gradients than had hitherto been deemed compatible with economy and safety. In this he was very successful; and when viewed in conjunction with the previously-mentioned general features of his professional life, it must be conceded that the decease of Mr. Locke had caused a great gap in the profession, which would long be felt.

It would be improper to close this hasty sketch without alluding to the extent to which both Mr. Locke and Mr. Robert Stephenson had acquired the confidence and esteem of a large circle of friends in the House of Commons. They had ably maintained the dignity and the independence of an important profession, which should always be adequately represented in Parliament. They went there without any personal objects beyond that of fair ambition to attain an honorable position; whilst there, they were eminently useful, and it might be hoped that before long other active useful members of the profession would assume their places in the House.

The discussion upon Mr. SCOTT's Paper, *On breakwaters, Part II.*, which was commenced at the closing meeting of the last session, but but was not then concluded, was continued throughout the evening.

It was remarked, that in shallow surface waves, the action of the oscillating water might be successfully resisted by pitched stone walls, concave and cycloidal outwardly. But a true breakwater must produce tolerably smooth water, not in the case of oscillating waves in shallow foreshores, but in heavy waves and deep water. A ground swell consisted of waves of translation, occompanied by oscillating surface waves. These two classes must co-exist in deep water, after a heavy storm. Heavy "rollers" like those off the Cape of Good Hope were waves of translation, consisting of vast masses of solid water moving in one direction with great velocity. Their action was nearly as powerful at a great depth as at the surface. They were like the tidal "bore" of the Hooghly, or the Severn, or the Dee. They could not be diverted, but must be stopped or broken. This could only be done by a mass heavy enough to be undisturbed by the momentum. A wall of vertical masonry was considered to be the best reflector—cost and durability apart; but a wall inclined at an angle of 45° would also reflect a wave of translation, and at this inclination large blocks judiciously placed would not be disturbed, even although a considerable breach was made in the wall near them. When any approximation to reflection of the wave, by walls not too remote from the vertical face, was abandoned, then reliance must be placed on breaking the wave. For breaking the heavy ground swell, a long sea-slope, with the convex section rounded off at the forefoot, was thought to be the most suitable. The intention in this case was to cause the great wave to begin breaking as early as practicable, to make the breaking last some time, and thus insure the diminution of its momentum being as complete as possible—the wave breaking on itself, and not upon the stones. In practice, both the ground swell and the surface wave—or both waves of translation and of oscillation—had to be contended with. An upright wall, also a convex sea-slope and a vertical pier above, dealt with both. But it was contended, that an outer convex sea-slope of rubble, with a retired vertical wall, and a retiring slope on the top of it, was a better arrangement. Floating breakwaters did not destroy waves of translation; nor did open piles and gridirons stop waves of oscillation; but a number of parallel rows of piles would diminish waves of translation.

It was remarked that Kingstown Harbour had been constructed on the long-slope principle—the slope being 5 to 1—at a total cost of only eighteenpence per ton, an amount which had been exceeded by the cost of the scaffolding alone of some modern public harbours. The great breakwater at Portland was also constructed on the same system, and the present engineer had stated, in evidence, that vertical walls would only be necessary for quays or wharves on the inside. In deep water piers the long slope appeared, therefore, to be preferred to the upright face.

It was contended that the pier at Blyth could not, with propriety, be adduced as an example of the success of a work with vertical walls when exposed to a heavy sea. It was constructed on a ledge of rock, the surface of which was from 6 feet to 10 feet above the level of low-

water of spring tides, having a breadth of about 400 feet seaward of the pier. The seaward margin of the rock bore the name of the "Sow and Pigs," and was situated at a distance of 1100 feet from the foot of the pier, thus protecting it from heavy seas, which were broken half a nautical mile from the line of the pier. In addition to this great natural protection, there also existed, at 60 feet seaward of this work, an old long slope pier, which extended for a length of about 700 feet from the shore. The pier at Blyth was, however, a cheap and proper one for the situation.

In reference to Table Bay, it was stated, that the chief danger to shipping and to any breakwater in course of and after erection, arose from the gales from the north and north-westward. These were always accompanied by a heavy swell, the waves of which, from the configuration of the botton over which they passed, assumed the character of mountainous "shoal water waves." The greater portion of the breakwater would have to be constructed in water six or seven fathoms deep, or a short distance outside of the breaking point of the crest of the waves in the north-westerly gales. Looking at the model of the breakwater proposed by the author, and recalling to memory the volume and the peculiar character of the waves, the condition in which they would arrive at the proposed structure, the momentum and velocity with which they would be travelling, as well as the possibility of gales occuring during the progress of the works—the opinion that the proposed structure was inapplicable could not but be concurred in. And even if the work could be completed, so far from the waves being broken up, or neutralized, it was believed, to use a sailor's expression, they would go "clean over it;" and that, by the action of a succession of such waves, the entire fabric would be speedily reduced to the state of a dangerous shoal water reef in the entrance of the Bay.

It was urged that no uniform rule could be laid down, as to the best form and material for maritime works. It might be safely stated, that the comparative suitability, economy, and duration of any hydraulic work would be almost, if not entirely, proportionate to the amount of knowledge and skill bestowed on the preliminary survey of the physical features and hydraulic phenomèna of the locality. The misconceptions arising from the terms "wave of oscillation" and "wave of translation," as applied to the wind-waves of the ocean and sea coast, had, it was thought, contributed in no small degree to the many crude and impracticable schemes which from time to time were brought forward as universal modes of constructing breakwaters and sea defences.

It was observed, that the discussion resolved itself into two separate questions—the one, as to which was the best form of wall, in a theoretical point of view, to resist a deep sea wave; the other, the cost of securing that form; and the consideration of cost might lead to the adoption of the less perfect line. It was argued that the vertical wall was preferable to either the cycloidal, or the long slope systems; and the objection to vertical walls, that they were liable to be breached, was not considered to be valid. If stone was abundant and cheap in the neighbourhood of the works, a rubble breakwater, though requiring more than ten times the amount of material which might be necessary for an equally strong vertical wall in the same situation, might yet be

the more economical structure; but where stone was scarce and dear, the pierre perdue system was inapplicable. In fact, each case must be separately considered.

It was thought, that as the hydraulic laws which regulated the motion of waves were fixed and immutable, although the local circumstances might vary in each, yet that some definite conclusion could be arrived at, as to the best form of breakwater; first, for the deep water oscillating wave, and secondly, for the shoal water wave of translation, or wave of percussion. It was believed that the long rubble slope, say of 7 to 1, between the levels of high and low water, which converted the deep water oscillating wave into a wave of translation, was an error of construction, not only as regarded original costs, but also future maintenance of the works. The long sea slope was exposed both to the percussive action of the waves of translation, and to the recoil of the sea, or what sailors termed the under-tow of the wave. In shallow water, with insecure foundations, the cycloidal form was looked upon as the best; but in deep water, for resisting the simple oscillating wave, the vertical wall would be found to be the most economical and durable, and the proper form.

It was contended, that in constructing Harbours of Refuge, the object need only be to break the great force of the waves, and not to endeavour to secure such smooth water within, as to enable trade to be carried on, which should be done in an interior harbour, alongside quays. There were several advantages in keeping the superstructure low, say not above high water of equinoctial spring tides. In a military point of view, such a breakwater would act as a glacis to vessels of war inside, over which they could deliver their fire, and be themselves protected, to a great extent, from an enemy outside. It was asserted, that the expense of building the counter-forts, shown in the design proposed by the author, would be greater than building a second longitudinal wall; and that the cost of the whole work would be much in excess of what had been estimated. Also, that a heavy wave, striking upon the gridiron surface formed by the iron girders spanning the intervals between the counter-forts, would have a greater tendency to run up and over the work in a body, than to pass between them and be divided.

In reply, it was assumed, that the principle which had been contended for seemed now to be admitted—namely, that the vertical face was the best form hitherto employed. But it was thought by some that the vertical face could only be obtained at great expense. Cost, no doubt, must decide the question; but by adopting the system advocated in the former paper, of first constructing a timber breakwater, and subsequently facing it with stone, it would be found that the vertical face was the cheapest as well as the best. The gridiron breakwater, it was assumed, would be better still, where there was a heavy sea and small rise of tide, and was the form best fitted to deal with waves of great magnitude. It had been said, that rollers could only be broken by opposing mass to mass. The object of the new design was to break the wave without opposing mass to mass. It had been proposed to place an isolated mass of stonework parallel with the breakwater seaward. This would be effective, but it would constitute a second breakwater, and as the slopes must be long, it would be expensive. It

had been objected, that the water passing between the girders would strike the counter-forts obliquely, and that they would receive the whole force of the blow. This was tantamount to saying that the sea came end on, and that there was no grating. The only surface exposed to the blow of the sea was iron. As to the objection that the water would pass through and reproduce a wave, supposing the worst case that the water passed through a number of spaces at the same moment, each body of water in falling would produce a wave, but these small waves would neutralise each other. The misconception arose from considering a sloping screen, with horizontal bars, to be the same as a vertical screen with vertical bars, and ignoring the fact, that whereas, in the latter, the water passed through at the same moment, leaving the continuity of the wave unbroken, in the former, it passed through in detail, and at successive periods of time, whereby the continuity was destroyed. The principle of a screen with horizontal bars had been tried on a small scale, and was successful. It was thought that the only forcible objection that had been taken to the new form was, that part of the wave might go over the top of the slope. Now if a slope 80 feet in width was not sufficient to prevent that, then 100 feet or 120 feet could be tried, and even then it would only cost £126 per foot run, which, it was contended, was less than any other form to be equally effective. The breakwater could first be built 80 feet in width, and any addition could be made afterwards; whilst every addition to the efficiency of a vertical wall, by increasing the height, diminished its strength, every increase to the efficiency of the proposed work added to its strength; because every foot added to the height involved an increase to the width of two feet. The counter-forts would be composed of massive blocks of rubble masonry, so interlocked and set in cement that they would constitute one solid mass.

With respect to the portion of the breakwater at Blyth before the meeting, it was apprehended that there had been some misconception regarding the principles upon which it had been constructed. The straight part of this portion of the work was so like, in external appearance, some other works, that it had been assumed by many to be similar, whereas in principle and action it was quite different. The fundamental idea had been that the work should rest on and not be attached to the ground, but that its stability should be entirely dependent on the weight of the stone filling, and independent of any ground fastening. The second object was so to combine the timber and stone that they would form one whole. Both these objects had been effected, but attention was drawn to the fact, that an apparently slight change in either the form or in the details of construction would be attended with great danger to the structure. It was observed that there were other peculiarities, one being the great facility afforded by the system of framing the timber on shore and depositing it complete in its place. It was thought necessary to make these observations, because this system of construction was being adopted elsewhere, and if attention was not directed to these unimportant details, in reality involving principles, success could not be expected.

In closing the discussion, it was remarked, that the question of breakwaters was still in an unsatisfactory position, as there were but few facts or data upon which to form an opinion. It would be inter-

esting to be informed, and indeed the profession was fairly entitled to ask, what was the cost per lineal yard of the breakwater at Alderney in 20 fathoms water, where the stone had to be quarried by the contractor, as contrasted with that at Portland in 10 fathoms water, where the stone was quarried by convicts.

November 20, 1860.

The paper read was, "*On the River Orwell and the Port of Ipswich,*" by Mr. George Hurwood, M. Inst. C.E.

It was stated, that the river Orwell had a north-westerly direction from the harbour of Harwich upwards to the town of Ipswich, where it met the lock of the inland navigable river Gipping; the distance from Harwich to Ipswich being twelve miles. Towards the close of the last century, the river had been so encroached upon and neglected, that the trade and commerce of the port of Ipswich was seriously affected. At that time there was only five feet of water at neap, and eight feet at spring tides at the quays, so that it was usual for vessels to load and unload their cargoes from and into small craft at Downham Reach, about three miles below the wharfs. A committee of the leading merchants, shipowners, and inhabitants, therefore, determined to take the opinion of Mr. W. Chapman, Civil Engineer, of Newcastle-on-Tyne, who submitted a report in 1797, accompanied by two distinct plans, and estimates of the probable cost of carrying each into effect. In his report, Mr. Chapman investigated the causes of the bad state of the river above Downham Reach, which he attributed partly to the great irregularity of its course, but mainly to the reduction in the quantity of tidal water, due to the silting up of the bed of the river, and to the enclosure of 120 acres of land above Stoke Bridge, sixty acres below that point and Nova Scotia, and from six to seven acres between the Cliff Brewhouse and the Rope Yards.

To remedy these evils, Mr. Chapman proposed to construct a tidal or sea lock near Downham Reach, and a canal, with a navigable depth of sixteen feet, from thence to a basin before the quays. The other plan was to improve the river itself, by deepening the channel and by cutting off the abrupt bends, thus reducing the length in the distance of twelve miles by one mile. He pointed out, however, that straightening alone, without providing an additional current of water, would not be productive of sufficient effect. But he was of opinion that if an equivalent quantity of tidal water could be obtained to that which formerly flowed over the land before it was embanked from the river, this, in aid of the greater straightening of the course, would produce the desired effect. The estimated cost of the two plans was £27,000 and £17,000 respectively. Mr. Chapman gave a decided preference to the former, and, in subsequent reports, urged its adoption. Finding that the expense was objected to, he, in order to reduce it, suggested that the navigable depth should not be made more than thirteen feet, and he proposed to place the entrance lock at Freston Reach, so as to shorten the length of the canal.

The bent of public opinion was against the adoption of the former project, and in the year 1803, at a meeting of the inhabitants, it was

resolved to apply to Parliament for power to improve the river, in accordance with the second plan. This induced the Act of 1805, which virtually took the managing power out of the hands of the corporation, and placed it in those of the principal merchants, shipowners, &c.

The first work of importance undertaken by the Commissioners was the making of a new channel at Cliff Reach. About the year 1819, a similar work was carried through Round Ooze, to avoid the circuitous and difficult route by John's Ness. In the year 1821, under the advice of Sir W. Cubitt, a new channel was cut from the upper end of Limekiln Reach to the lower end of Hog Island Reach. These works so improved the river, that in 1826, vessels drawing about eleven feet of water could reach the quays at spring tides. Yet, notwithstanding the outlay which had been incurred, the Commissioners had saved from the revenues of the port and the river a sum of £25,000. Further improvements were therefore determined upon, and under the advice of the late Mr. H. R. Palmer, powers were obtained, in 1837, to construct a wet dock. In 1842, the works were sufficiently advanced to maintain the float, and in 1847, a new channel was finished through Black Ooze. The bends from Cliff Reach to the Upper Hearth Point, the Lower Hearth Point, and also Wherstead Reach Point, where awkward projections existed, had all been considerably reduced. The channel from the lock of the wet dock to the deeper water near Downham Reach had been dredged to a depth of one foot below the top of the lock cill, and shoals were removed as soon as they were formed. The effect of these continuous and combined operations had been to give a depth of water from the sea of the wet dock of sixteen feet four inches at average spring tides, and an average low water depth of not less than three feet three inches. When the wet dock was opened in 1842, vessels of about thirteen feet draught of water could reach the dock at average spring tides. The object had since been not only to increase the depth by dredging, but to bring the channel course into a good condition, and to regulate the capacity where necessary, so as to make the navigation easier. Every available means had been adopted to encourage the easy flow and ebb of the tide, and to prevent any encroachment upon space previously covered by tidal water, particularly in the upper part of the river, and wherever opportunity offered, to enlarge the receptacle to receive it, as the author believed that the preservation of the river entirely depended upon the tidal operations. There was a rise and fall of tide at Harwich of eleven feet six inches, and, at Ipswich Dock, of thirteen feet seven inches. The rate of spring tides, within two or three miles of Ipswich, was about one knot and three-quarters per hour. The duration of the flood and of the ebb tide at Ipswich Dock was nearly equal, and the stationary state of the tide at low water was of short duration, and seldom perceptible. The cost of the wet dock, and of the works connected with it, amounted to about £130,000.

It might be stated that, before the commencement of the works, the depth of water to Ipswich Quay was only eight feet, whereas now it was sixteen feet four inches. At the former period, the tonnage of the registered vessels belonging to the port was less than 7000 tons, whilst at the present time it amounted to 16,274 tons.

The communication was accompanied by an appendix, including

copies of the reports made by Mr. Chapman, Mr. Palmer, and the author, as well as of the various forms used in recording the transactions of the port, and detailed particulars of the cost of all the works.

TRANSACTIONS OF MECHANICAL ENGINEERS' SOCIETY.

"*Description of a method of taking off the waste gases from blast furnaces*," by Mr. CHARLES COCHRANE, of Middlesborough.

THERE is no novelty in the fact of taking off the waste gases from a blast furnace; for many methods have been and are at present employed for accomplishing this object. Though the writer was unaware of any similar method, it is not desired to claim originality in that about to be described; but as there is such acknowledged diversity of opinion as to the respective merits of different plans, and great difficulty in procuring reliable information on any, it is proposed to give a description of an arrangement which has been in successful operation for some months at the Ormesby Iron Works, Middlesborough, and bids fair to realise the best expectations of its merits. The large waste of fuel from the mouth of a blast furnace, where the escaping gases are allowed to burn away, is well known, and amounts to more than 50 per cent. of the fuel burnt; hence there is considerable margin for economy, bearing in mind the large quantity of coals consumed in raising steam for generating the blast and the further quantity necessary to heat that blast to the required temperature. In fact, assuming a consumption of 300 tons of coke per week to make 200 tons of iron, about 100 tons of coals would be required to generate steam and heat the blast. Taking off the gases from one furnace under such conditions, does, according to actual experiment, furnish gas equivalent to upwards of 150 tons of coal per week. This is obviously an important matter where coals are expensive.

The blast furnace is alternately charged with coke, ironstone, and limestone, in proportions depending upon the quality or "number" of iron desired. The arrangement of these materials in the furnace is generally deemed important, though it admits of considerable latitude without any appreciable alteration in the working of the furnace. Thus it does not seem to be of any importance whether the charge of coke be 12 cwts. or 24 cwts., the amount of load of ironstone and limestone being the same proportion of 1 to 2. The chief point, if there be one, to be gained in the arrangement of the material, is to distribute it pretty equally over the furnace, not allowing all the large material to roll outwards, and the small to occupy the centre of the furnace, or *vice versâ:* for it is supposed the ascending gases will pass through the more open material of the furnace to the injury of the closer; thus the two reach the active region of reduction in different states of preparation, and the operations of the furnace are interfered with. To provide for this contingency, which is met in an open-topped furnace by filling at the sides at three, four, or even six points of the circumference of the throat, allowing the material to slide inwards 2 or 3 feet on a sloping plate, it was considered expedient in the present instance to make the filling aperture as large as practicable: it was therefore made 6 feet 6 inches diameter, so that the material

tends to arrange itself in a circle a little outside the centre, thus correcting the tendency of large material to roll outwards by causing a similar tendency to roll towards the centre also. This point is gained in one of the simplest methods in use for closing the top of a blast furnace, where a cone is used to lower into the furnace for filling; but it is secured at the expense of the height of material in the furnace. A certain height is necessary for the efficient working of the furnace, and if this be diminished, it must be at the expense of fuel in the furnace; since the absorption of heat from the gases depends on the height of material through which they have to pass up: if this be diminished, the gases issuing from the throat of the furnacewill escape at a higher temperature; if increased, at a lower.

But there is an important difference to consider in the conditions of a closed and an open-topped furnace, to which the writer is not aware that attention has hitherto been drawn—a difference which acts somewhat in favor of the open-topped furnace. The working of the furnaces themselves seems to show that an open-topped furnace is less sensitive to irregularities of moisture in the material, quantity of limestone, size of material, &c.; which can be accounted for only by the fact that the open-topped furnace has the advantage of a large amount of surplus heat due to the combustion of the waste gases at its throat, which serves to dispel moisture and calcine the limestone, and helps to warm up the large pieces of ironstone; all of which operations in the close-topped furnace are effected only at a lower point of the furnace—thus necessitating a larger consumption of coke. With the same proportion of ironstone to limestone, it has been found to require about 10 per cent. more fuel to produce the same number or quality of iron in a close-topped, than in an open-topped furnace. In the close-topped furnace, the gases pass away at a temperature of about 450° Fahr.; whilst, in the open-topped, a temperature of between 1000° and 2000° is generated in the throat of the furnace by their combustion.

In comparing the extra quantity of coke consumed in a close-topped blast furnace with the saving in coals for the boilers and hot-blast stoves, it is obvious that the economy to be derived by taking the gases off depends on the comparative value of coke and coal. In the Middlesborough district, where coal is expensive, it is an undoubted source of economy; where coke is very dear, however, and small coal can be obtained at a mere nominal cost for boiler and stove purposes, the use of the waste gases would possibly do little more than compensate for the outlay involved. Here, no doubt, is one source of the variety of opinion entertained in various districts as to the advantage of taking off the gas. The writer's experience at Middlesborough has been that the waste gases can be taken off without affecting the quality of the iron produced, though at the expense of more fuel.

The mode of closing the furnace top, and taking off the gases at the writer's works, is as follows:—The top of the furnace is closed by a light circular wrought-iron valve 6 feet 6 inches diameter, with sides tapering slightly outwards from below, to admit of being easily drawn up through the materials, which are tipped at each charge into the surrounding external space. To prevent excessive wear upon the body of the valve, shield plates are attached at four points of its circumference, against which the material strikes as it rolls out of the barrows. An annular

chamber, triangular in section, encircles the throat of the furnace into which the gas pours through eight orifices from the interior of the furnace, and thence passes along a tube into an adjacent chamber. At the extremity of the tube is placed an ordinary flap-valve opened by a chain, by means of which the communication between the furnace and the gas main which descends from the chamber may be closed. The circular valve is partially counterpoised by a balance weight, and is opened by a winch when the surrounding space is sufficiently full of materials. At the time when the blast is shut off for tapping the furnace, the gas escapes direct into the atmosphere through a ventilating tube, which is connected by levers with the blast inlet valve below.

The connection between the furnace top and the hot-blast stoves to be heated by the waste gases, is effected by the descending main which connects at its lower end with a horizontal main running parallel and close to the line of stoves; and from this main descends smaller pipes to each stove. The supply of air for burning the gas in the stoves is admitted through tubes which can be regulated at pleasure by a circular pierced slide covering the ends of the tubes. The ignition takes place where the air and gas meet, the ignited gas streaming into the stove and diffusing its heat uniformly over the interior. An important element in the working of an apparatus of this description is to provide for explosions, which must take place if a mixture of gas and air in certain proportions is ignited. To provide for this contingency, escape valves are placed at the ends and along the tops of the main tubes: but to prevent explosions as far as possible, the ventilating tube before mentioned is used at the top of the furnace, connected with the blast valve at the bottom; so that when the valve is closed, as at casting time, the act of closing opens the ventilating tube, and allows the gas to pass away direct into the atmosphere. The gas would otherwise be in danger of slowly mixing with air passing back through the stoves, or otherwise gaining access into the tubes, and would thus give rise to an explosion: until the ventilating tube was provided, it was necessary to lift the valve closing the mouth of the furnace when the blast was taken off, otherwise slight explosions took place from time to time.

In the use of Durham cokes in the blast furnace an inconvenience arises from the large deposit which takes place in the passage of the gas from the furnace and in the stoves and boilers. Under the boilers this deposit is a great objection, as it is a very bad conductor of heat, and needs to be frequently removed; in the stoves it is not so objectionable, though these need a periodical cleansing.

The writer has heard it asserted, that the closing of the top of the furnace is the source of mischief to its working, by producing a back pressure in it. Under ordinary circumstances, with the furnace top open, the blast enters the tuyeres at a pressure ranging from $2\frac{1}{2}$ to 3 lbs. per square inch. In the present close-topped furnace there are eight outlet orifices, each 2 feet by one foot, giving a total area of 16 square feet for the passage of between 5000 and 6000 cubic feet of gas per minute, raised to a temperature of 450° Fahr.; and the actual back pressure of the gas as measured by a water gauge, inserted into the closed top of furnace, is from $\frac{1}{2}$ to $\frac{5}{8}$ inch column of water, or about 1-40th or 1-50th of a pound per square inch, an amount so trivial, as compared with a pressure of from $2\frac{1}{2}$ to 3 lbs., as to be unworthy of notice. Of course, if the tubes

are contracted in size, a greater back pressure will be produced; and it is quite possible that, where attention has not been paid to the circumstance, the back pressure may have interfered with the working of the furnace by preventing the blast entering so freely.

As regards economy in the wear and tear of hot-blast stoves of the ordinary construction, there can be no question the pipes last much longer when heated by gas, provided the temperature of the stove be carefully watched to prevent its rising too high; whilst the value of the same heating surface compared with its value when coals are used, is greatly increased, owing to the uniform distribution of the ignited gases throughout the stove. In the use of the gases at the writer's works, this economy of surface is such, that two stoves heated by gas will do the work of a little more than three heated by coal fires.

Mr. W. Matthews considered the subject of economising the waste gases from blast furnaces was one of much importance, and was glad it had been so ably taken up in the paper just read. He asked whether there was found to be any material difference in the working of the close-topped furnace, and whether the closing of the top for the purpose of taking off the gases interfered with the burden of the furnace or the quality of iron produced. If the quality and yield of iron were not disturbed, the utilization of the waste gases must be a source of economy where fuel was dear; but otherwise, where coals were cheap, it might hardly be worth while putting up an apparatus for taking off the gases. In the case of some blast furnaces lately erected at Heyford, in Northamptonshire, where the ore was cheap but coal expensive, costing 14*s.* or 15*s.* per ton at the furnaces, the iron could not have been worked profitably unless the waste gases were taken off; this had accordingly been done, and he understood had proved thoroughly successful, reducing the cost of making the iron greatly.

Mr. C. Cochrane replied, that the regularity of the furnace was certainly interfered with, though only to a slight extent, by closing the top, and the furnace was rendered more sensitive. In the first trials of the close-topped furnace mottled iron was made frequently, and occasionally white iron; but by exercising sufficient care in managing the furnace, the irregularities were now in a great measure got over.

Mr. C. Markham had been connected with some blast furnaces at Marquise, in the north of France, fourteen years ago, from which the waste gases were taken off very successfully; and thought the mode of carrying out the plan in that case was superior, owing to the gases being conveyed upwards to a higher level to be burnt, as they would naturally rise by reason of their specific gravity being less than that of the atmosphere. There were two furnaces built side by side against a bank, and the gases were taken off about 5 or 6 feet below the top, by a circular flue running all round the furnace; they were taken under six Cornish boilers situated at the top of the bank, a few feet above the top of the furnace. The gases were drawn off from the furnaces by a chimney 90 feet high, and they frequently produced a large flame from the top of the chimney. The evil of the gases firing subsequently to passing under the boilers was removed to a considerable extent, by the erection of an additional flue, which caused the gases to be more perfectly mixed with air and fired before they were cooled down, by coming in contact with the boilers. The

regular make of each furnace was 100 to 120 tons of cold blast-iron per week, and the consumption of coke was about $1\frac{1}{2}$ tons per ton of iron made. The coke cost 30*s.* per ton, so that economy of fuel was of great importance; the boilers were worked entirely by the waste gases from the furnaces.

Mr. C. W. Siemens had seen furnaces working at Charleroi, in Belgium, where the gases were drawn down from the top of the furnace without any difficulty, by means of a pipe inserted in the side of the furnace near the top; but it was found necessary to allow at least one-third of the gas to burn out of the mouth of the furnace, otherwise the working of the furnace was interfered with, and neither was the iron of such good quality, nor the gas so effective for heating purposes.

Mr. Samuel Lloyd said they had now adopted a plan for taking off the waste gases at the Old Park furnaces, and had it working there successfully for some weeks, without any injury being caused to the working of the furnace; the iron seemed, if anything, to be rather better in quality, a little more grey, and somewhat increased in quantity. The plan was that of Mr. Darby, of Brymbo, in North Wales, where it had been at work successfully for two years past; it consisted of a plain upright tube inserted into the centre of the open mouth of the furnace, and then carried over down the outside of the furnace, where the gas was burned under the steam-boilers, the flues of which were connected with a sufficiently tall chimney to produce a draught for drawing down the gas. The large area between the tube, of five feet diameter, and the mouth of the furnace of ten feet diameter was left open, so that there was no pressure on the furnace, which worked in that respect exactly like an open-topped furnace. The tube was inserted about five deep into the materials at the top of the furnace, and by this means they got four boilers heated by gas without any cost for fuel. He thought this plan of leaving a large portion of the furnace top open was the only practicable way of taking off the waste gases in the South Staffordshire district, where it was of the first importance that grey iron should be made, and considered it was a great improvement on the closed-top system; for the open top of the furnace allowed the extra quantity of gas to escape direct into the atmosphere; but with a closed top the top of the furnace was choked, and the accumulation of gas was liable to produce a back pressure on the furnace, which they had found by experience was very injurious.

Mr. T. Snowdon thought, in working with close-topped furnaces for taking off the gases, a great deal depended on having a sufficient height of chimney to ensure drawing off the gas with regularity; if the chimney were only as high as the furnace, the two columns of gas would balance each other, and there would be no power of draught. The draught required, however, seemed to vary much in different furnaces; for in the Clay-lane furnaces at Eston, near Middlesborough, the chimney was only a few feet above the top of the furnace, but produced quite draught enough, while he had seen other furnaces with higher chimneys that were not working well. At his own furnaces at Middlesborough, he would have preferred placing the boilers and hot-blast stoves at the top of the furnace if it could have been done, in order to take the gases direct to them; but this was not practicable, and the gases were therefore drawn down from the top of the furnace by a chimney 120 feet high and 8 feet square, having 64 square feet area of draught. The temperature and

nature of the gases taken off depended greatly on the burden of the furnace, according to the quality of ironstone that was being worked: with a heavy charge of limestone the gas would not burn without great difficulty, owing to the carbonic acid gas mixed with it, and he had noticed that when the gases were best for burning, the temperature was so low in the top of the furnace that the materials were quite damp, and a long rod thrust in was drawn out covered with moisture. The gases ought never to be taken off hot through the tubes, if it could be avoided; and at Valenciennes, in France, some of the best working furnaces he had seen were quite cool at the top; the gases being entirely taken off and the tops closed. He was so confident of the practicability of using the waste gases, that no provision had been made for a fire in the hot-blast stoves at his own works; but they had to put in a fire at first on starting the furnaces, though it was now used very little, and mainly at the time of starting. Some of the boilers were working without any coal fire, being heated entirely by gas; and the total quantity of coal used both for boilers and hot-blast stoves was less than 1½ cwt. per ton of iron made: the coal was a mixture of small coal and slack, costing only 4*s.* per ton. The use of gas saved the attendance of men for firing under the boilers and stoves.

PROVISIONAL PROTECTIONS GRANTED.

1860.

[*Cases in which a Full Specification has been deposited.*]

2651. William Tileston Vose, of Massachusetts, U.S.A., for an improved pump or portable fire annihilator.—[*Dated October 30th.*]

2759. Charles Stevens, of Welbeck-street, for an improved machine for raising water,—being a communication.—[*Dated November 9th.*]

2771. Hiram Edwin West, of Attleborough, Massachusetts, U.S.A., for a machine for pressing and shaping straw hats or various other articles of like character,.—[*Dated November 12th.*]

[*Cases in which a Provisional Specification has been deposited.*]

1810. Thaddeus Fowler and De Grasse Fowler, both of Northford, Connecticut, U.S.A., for improvements in machinery for manufacturing pins.—[*Dated July 25th.*]

2220. Charles Theodule Launay and Auguste Marie Alexandre Dominé de Vernez, both of Paris, for improvements in treating coal naphtha and in apparatus employed therein.

2228. Paul Pautard, of Castres Tarn, France, for an improved apparatus for supplying air to persons in water, and in mines or other places,—being a communication.

The above bear date September 14th.

2257. George Frederick Smith, of Golden-square, for improvements in the smelting of iron and other ores,—being a communication.—[*Dated September 17th.*]

2284. David Jones, of Machen, Newport, Monmouthshire, for an improved method of, and apparatus for, raising water and other liquids.

2290. Victor Hippolyte Laurent, of Plancher-les-Mines, Haute Saone, France, for improvements in machinery or apparatus for forging nails, screws, bolts, rivets, and railway spikes.

2297. Joseph Roberts Morley, of Wood-

bridge, Suffolk, for improvements in the manufacture of baking dishes.

The above bear date September 20th.

2302. Auguste Armand Trinquier, of Paris, for improvements in surveying instruments.

2303. Robert Smith, of Islington, for covering of iron, wooden ships, yachts, steam-boats, and barges' bottoms and outsides.

2304. John Fisher, of Carrington, Nottingham, for improvements in machinery or apparatus for treating clothes and other articles whilst in a wet condition, for the purpose of drying or partially drying the same.

The above bear date September 21st.

2332. James Ferrabee, of Stroud, Gloucestershire, and Henry Ferrabee, of Camberwell, for improvements in apparatus for lighting, heating, ventilating, and cooking by gas, and part of which invention is applicable to heating apparatuses of other descriptions.

2342. Ludwig Buchholz, of Gottenburg, for improvements in carbonizing sawdust and other finely divided vegetable substances, and in obtaining certain useful products by such carbonization, and in apparatus connected therewith.

The above bear date September 26th.

2372. George Rutter, of Great Guildford-street, Southwark, for improvements in machinery and apparatus for and in treating flax, hemp, Rhea, China grass, New Zealand flax, plantain, and all other vegetable and animal fibres.

2380. Elizabeth Steane, of Commercial-place, Brixton-road, and Francis Palling, of Esher-street, Lambeth, for an improved means or apparatus for preventing candles dropping or guttering.

2385. John Brokenshire, of Bowmanville, Canada West, for improvements in pumps.

2386. James Lee Norton, of Belle Sauvage-yard, for improvements in apparatus used in tentering, or stretching and drying fabrics.

2387. George Edward Taylor, of Leeds, for improvements in apparatus used when boiling cloth.

2388. Colin Mather, of Salford, for improvements in machinery for shearing and singeing fabrics.

The above bear date October 2nd.

2389. Thomas Johnson, of Leicester-square, for an improved tobacco pipe.

2390. Joseph Bower and David Farrar Bower, both of Hunslet, Yorkshire, for an improvement in the manufacture of iron and cast steel.

2391. Robert James, of Faversham, for improvements in reaping and mowing machines.

2392. Alexander William Williamson, of University College, and Loftus Perkins, of Francis-street, Gray's-inn-road, for improvements in steam-engines.

2393. Joseph Hadley Riddell, of Cheapside, for improvements in boilers.

2394. Edward Thomas Hughes, of Chancery-lane, for improvements in healds or heddles employed in looms for weaving,—being a communication.

2395. Richard John Cole, of Pembridge-gardens, Bayswater, for improvements in ornamenting the windows of public and private vehicles.

2396. Arthur Irwin Mahon, of Dublin, for improvements in screw propellers; applicable also for raising and forcing water and other liquids, and obtaining motive power from the same.

2397. John Whitehead Greaves, of Port Madoc, Carnarvonshire, for improvements in slate dressing machines.

2398. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in lamps for burning coal oils and other hydro-carbons containing an excess of carbon,—being a communication.

2399. John Robinson, of Rochdale, for improvements in machinery, commonly called log frames, for sawing timber.

The above bear date October 3rd.

2400. Charles Whicher, of Crozier-street, Lambeth, for an improved machine for applying steam in a manner to cause direct rotation,—being a communication.

2401. Charles Cowper, of Southampton-buildings, for improvements in the manufacture or extraction and application of colouring matters from the

products of the distillation of coal tar, —being a communication.

2403. Louis Prosper Reynaud, of Paris, for an improved buckle.

2404. John Sootheran and John Carr, both of Pickering, Yorkshire, for improvements in reaping machines.

2405. Michael Jones, of Lidlington-place, Camden-town, for improvements in rifles and other firearms, whereby to insure greater accuracy in the use of the sights.

2406. Henry Fley, of Cross-street, Wilderness-row, for improvements in signal lamps.

2407. James Morris, of Clapham, for improvements in holdfasts and guide pulleys for the cords of venetian blinds for windows.

The above bear date October 4th.

2408. Charles Tuckett, jun., of the British Museum, for an improved method of ornamenting book covers, which is also applicable to other purposes.

2409. Charles Callebaut, of Paris, for improvements in sewing machines.

2410. Thomas Wimpenny, of Holmfirth, Yorkshire, for a certain improvement in machinery or apparatus to be employed for spinning cotton and other fibrous substances.

2411. William MacNaught, of Manchester, for certain improvements in steam-engines.

2414. Auguste Brocchi, of Paris, for an improved waterproof cement or composition.

2415. Thomas Rickett, of Buckingham, for improvements in locomotive engines for common roads.

The above bear date October 5th.

2416. William Clegg, Thomas Wild, and James Tomlinson, all of Rochdale, for improvements in certain machines for preparing cotton and other fibrous materials. — [*Dated October 6th.*]

2417. Richard Medwin Hands, of Coventry, for improvements in dressing or giving lustre to silks, ribbons, and other fabrics, also to threads and yarns.

2418. William Salter Parkes, of West Bromwich, for a new or improved washing machine.

2419. William Beare Caulfield, of Cole Harbour, Blackwall, for slinging and raising sunken or stranded vessels.

2420. William Kennard, of Southgate-terrace, New North-road, for improvements in hanging window sashes.

2421. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in knitting machinery, and in the mode of operating the same,—being a communication.

2422. Edward Westhead, of Manchester, for improvements in generating steam, and in apparatus connected therewith.

2423. John Platt, of Oldham, for improvements in machinery or apparatus for forging or shaping cranks on bars of metal.

2424. Arthur Sarjeant, of Peckham, for an improvement in malt liquors.

2425. William Yates, of Bromley, for improvements in steam-boiler and other furnaces, and in apparatus connected therewith.

The above bear date October 6th.

2426. Bernhard Samuelson, of Banbury, for improvements in harvesting machines.

2427. Matthew Paris, of Hill Side, Wimbledon, for improvements in fire-arms.

2428. James Henson, of Parliament-street, Westminster, for improvements in the manufacture of chains for coupling or connecting the carriages, waggons, and other vehicles on railways, applicable also to various other purposes.

2429. David Cope, of Liverpool, for improvements in drums, kegs, casks, and like packages, and in machinery or apparatus employed in the manufacture of the same.

2430. Samuel Whitaker, of Liverpool, for improvements in the construction of fluid taps or cocks.

2431. George Hill Underwood, of Manchester, for improvements in finishing and stiffening textile fabrics.

2432. Edward Joseph Hughes, of Manchester, for improvements in the preparation of certain coloring matters, and also a process of printing and dyeing woven fabrics, yarns, and other substances,—being a communication.

2433. John Adams Knight, of Symond's Inn, for an improved lathe for ribbon looms,—being a communication.

2434. Henry Bright, of Sandwich-street, Burton-crescent, for an improved guard or cutwater for ships or vessels, for the purpose of lessening or preventing injurious effects resulting from collision.

2435. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for certain improvements in springs for railroad cars, locomotives, and carriages,—being a communication.

2436. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the treatment of ores and coal,—being a communication.

2437. Louis Julien Olivier Jolly, of Paris, for improvements in the means of winding up and setting watches,—being a communication.

2438. Joseph Calkin, of Oakley-square, for an improved apparatus for protecting the upper portion of the face from the inclemency of the weather, dust, or otherwise.

2439. William Clark, of Chancery-lane, for improvements in cleaning or separating gutta-percha from extraneous matters, and in apparatus for the same,—being a communication.

2440. William Clark, of Chancery-lane, for improvements in driving straps and belts,—being a communication.

2441. John Henry Johnson, of Lincoln's-inn-fields, for improvements in railways or tramways, and in carriage-wheels to be used thereon,—being a communication.

2442. Edward Gardner, of Maidstone, for improvements in machinery or apparatus employed in the manufacture of paper.

2443. Walter Hood, of Glasgow, for improvements in ladies' trousers, drawers, or other under clothing.

The above bear date October 8th.

2445. Jonathan Edge, of Bolton-le-Moors, for certain improvements in steam-engines.

2446. Edward Worthington, of Manchester, and Robert Mills, of Rochdale, for improvements in apparatus for preventing the retrogression of railway carriages on inclines.

2447. George Price, of Wolverhampton, for an improvement in the manufacture or construction of metallic armour for vessels of war, land defences, shields for ordnance, mantellets, &c.

2448. Charles Stevens, of Welbeck-street, for improvements in atmospheric railways,—being a communication.

2449. George Price, of Wolverhampton, for an improvement in metallic targets.

2450. George Waide Reynolds and Enoch Dance, both of Birmingham, for new or improved machinery for the manufacture of baskets and wicker work.

2451. Robert Anderson, of Liverpool, for improvements in apparatus for economizing and regulating the flow and passage of fluids for flushing water-closets.

2452. George Reid, of Liverpool, for improvements in ventilating houses, buildings, ships, and structures generally; and in apparatus for ascertaining the state of the atmosphere in the said houses, buildings, ships, and structures.

2453. Richard Hands and Richard Medwin Hands, both of Coventry, for improvements in lustering, stretching, and finishing silks, and other yarns or threads,—being a communication.

2454. James Chandler, of Creek-road, Deptford, for improvements in glass gauges for indicating the levels of liquids contained in vessels of any kind.

2455. Joseph Stockley, of Newcastle-on-Tyne, for improvements in apparatus for grinding, smoothening, and polishing plate glass.

2456. Joel Haywood Tatum, of New York, U.S.A., for improvements in the manufacture of candle-wick.

2457. Gaetano Bonelli, of Milan, for improvements in electric conductors and apparatus for transmitting telegraphic despatches.

2458. Francis Danby, of Exmouth, for an improved anchor.

2459. Arthur Granger, of High Holborn, for a better and cheaper kind of embossing press, for embossing or stamping paper, linen, and other articles.

The above bear date October 9th.

2460. John Ramsbottom, of Crewe, Cheshire, for an improved mode of lubricating the pistons and valves of

steam-engines and other machines actuated by steam.

2461. Thomas Barnett, of Beverley, Yorkshire, for improvements in machinery for drying grain, roots, and seeds, and for roasting coffee, cocoa, chicory, malt, and other vegetable substances.

2462. Charles Wheatstone, of Hammersmith, for improvements in electro-magnetic telegraphs, and apparatus for transmitting signs or indications to distant places by means of electricity; and in the means of, and apparatus for, establishing electric telegraphic communication between distant places.

2463. Aaron Hobson and James Hobson, both of Wirtemberg-street, Clapham, for an atmospheric trap for the prevention of smells arising from cesspools, drains, water-closets, urinals, or any other place where smell may arise.

2464. William Clark, of Chancery-lane, for improved signalling and indicating apparatus,—being a communication.

2465. Desmond Gerald Fitz Gerald, of Cambridge-street, for improvements in breech-loading firearms.

2466. John Scott, of Sunderland, for an improvement in the manufacture of anchors, and an improved apparatus to be employed therein.

2467. Arthur Maxfield, of Nottingham, for improvements in the construction of water-closets and urinals, together with flushing apparatus connected therewith; which said flushing apparatus is also applicable to the watering of gardens, the cleansing of windows, or for other purposes.

2468. Richard Hornsby, jun., of Grantham, Lincolnshire, for improvements in machinery used for washing, wringing, mangling, and churning.

2469. George Tomlinson Bousfield, of Loughborough Park, Brixton, for an eraser and pencil sharpener,—being a communication.

2470. George Frederick Stidolph and John Stidolph, both of Ipswich, for improvements in organs.

2471. Timothy Whitby, of Milbank-street, and William Dempsey, of Great George-street, both in Westminster, for improvements in applying springs to railway trucks, and to railway and other carriages.

The above bear date October 10th.

2472. Charles Stevens, of Welbeck-street, Cavendish-square, for an improved crinoline protector, or double petticoat,—being a communication.

2473. Frederick Collier Bakewell, of Haverstock-terrace, Hampstead, for improvements in furnaces,—being a communication.

2474. William Mattieu Williams, of Handsworth, Staffordshire, for an improvement or improvements in crayons, for writing, drawing, and marking.

2475. John Silvester, of West Bromwich, for a new or improved steam pressure and vacuum gauge.

2476. Thomas Wilson, of Birmingham, for improvements in paper files or holders.

2477. Jasper Smith, of Abbey-street, Bethnal-green, and Thomas Taylor, of Wellington-row, Bethnal-green, for improvements in the manufacture of chenille, and in machinery for that purpose.

2478. William Barker, of Cornbrook, for certain improvements in steam-engines.

2479. Etienne Joseph Hanon, of Paris, for improvements in the manufacture of vegetable albumine.

2481. John Coleman, jun., of Woburn, Bedfordshire, for improved apparatus for raising and stacking straw and other agricultural produce.

2482. Jasper Wheeler Rogers, of Robert's-town, Kildare, for improved means of, and apparatus for, collecting the excrement of towns and villages, and for facilitating the drainage of houses.

The above bear date October 11th.

2483. John Aaron West, of St. Helen's, Lancashire, for improvements in treating solutions containing sulphate of soda, also metallic and other matters, and in obtaining products therefrom.

2484. Richard Archibald Brooman, of Fleet-street, for improvements in machinery for cutting and packing cigars,—being a communication.

2485. William Edward Newton, of the Office for Patents, 66 Chancery-lane,

for improvements in the manufacture of furniture nails or tacks, and other articles provided with metallic pins or points,—being a communication.

2486. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improved fastening for window shutters and blinds,—being a communication.

2487. Jasper Wheeler Rogers, of Robert's-town, Kildare, for improvements in the mode of, and apparatus for, preparing peat for fuel.

2488. Thomas Wilson, of Birmingham, for improvements in breech-loading firearms, ordnance, and projectiles.

2489. Benjamin Rhodes and George Rhodes, both of Nottingham, for improvements in machinery, and in apparatus connected therewith, for the manufacture of bituminous pipes and other articles.

The above bear date October 12th.

2490. John Blackwood and William Blackwood, both of Craigton, Dumbartonshire, for improvements in apparatus for washing yarns or threads.

2492. John Henry Johnson, of Lincoln's-inn-fields, for improvements in the production of colors for dyeing and printing,—being a communication.

2493. George Wearing, of West Bromwich, for certain improvements in the manufacture of saucepans formed of cast-iron, and which said improvements are also applicable to the manufacture of general cast-iron hollow-ware.

2494. Samuel Reston, of Liverpool, for an improved rotatory engine.

2495. William Clark, of Chancery-lane, for improvements in lubricating apparatus,—being a communication.

2496. Richard Archibald Brooman, of Fleet-street, for improvements in lenses,—being a communication.

2497. Martin Deavin, of Crystal-terrace, Rotherhithe, for an improvement in gymnastic apparatuses known as see-saws, and an improved mode of working the same.

2498. Horace Welch Harding, of Regent-street, for an improved combined sandwich-case and drinking flask.

2499. John James Russell and Burdett Lambton Brown, both of Wednesbury, for improvements in apparatus used for supplying steam from steam boilers or generators.

2500. Thomas Carlyle Hayward, the younger, of Highbury-park North, for improved ship's signals for day and night.

2501. James Higgins and Thomas Schofield Whitworth, both of Salford, Lancashire, for improvements in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous materials.

The above bear date October 13th.

2502. Weston Grimshaw, of Lytham, Lancashire, for certain improvements in apparatus for superheating steam in locomotive steam-engines.

2503. George Davies, of Serle-street, for an improved method of, and apparatus for, refrigerating and freezing,—being a communication.

2504. Joseph Thomas Webster, of Mansfield, Nottinghamshire, for an improvement in driving the spindles of doubling frames.

2505. Cable Brennand and John Brennand, both of Manchester, for improvements in ornamenting lappets, petticoats, window curtains, blinds, and similar articles.

2506. Samuel Roberts, of Hull, for improvements in steam-engines.

2507. Charles Stevens, of Welbeck-steeet, for an improved machine for cutting out bricks and drain-pipes,—being a communication.

2509. Isaac Merrit Singer, of New York, U.S.A., for improvements in the construction and fitting of steam vessels.

2510. Alexander McDougall, of Manchester, for improvements in materials or compositions for destroying vermin on sheep and other animals, and for protecting them therefrom.

2511. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in tools or machines for the manufacture of certain kinds of metallic tubes,—being a communication.

2512. Charles Burn, of Delahay-street, Westminster, for improvements in tram-rails for street railways.

2513. Charles Burn, of Delahay-street,

Westminster, for improvements in the permanent way of street railways.

The above bear date October 15th.

2515. Joseph Bent, of Newhall-street, Birmingham, and Joseph Luckock, of Harborne, Staffordshire, for certain improvements in ladies' clasps, and which said improvements are also applicable for connecting or holding waistbands, belts, and other articles of dress.

2516. John Bergen, of Long-lane, West Smithfield, for improvements in chimney pots.

2517. Charles John Burnett, of Edinburgh, for improvements in breech or muzzle loading ordnance.

2518. Richard Roberts and Thomas Edward Symonds, both of Adam-street, Adelphi, for improvements in marine steam-engines, and in machinery and apparatus connected therewith.

2519. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in constructing railways,—being a communication.

2520. John Louis Jullion, of Tynemouth, for an improvement in the manufacture of paper.

2521. John Louis Jullion, of Tynemouth, for improved machinery for making fences,—being a communication.

2522. Sidney Frankau, of Bishopsgate-street Within, for improvements in plugs for smoking pipes.

The above bear date October 16th.

2523. Francis Xavier Kukla, of Pentonville-road, for improvements in apparatus for heating stoves by gas.

2525. William Henderson of Alderley Edge, Cheshire, and Jonathan Down, of Alderley, Cheshire, for improvements in obtaining copper, silver, tin, and several other metals, from their ores or any other natural or artificial compound containing one or more of these metals.

2526. Joseph Ridsdale, of the Minories, for improvements in apparatuses for signalling, particularly applicable to marine engine room telegraphs.

2527. James Palmer Budd, of the Ystalyfera Iron Works, Swansea, for improvements in the manufacture of terne plates.

2528. William Clarke and Samuel Butler, both of Nottingham, for improvements in the manufacture of fabrics in twist-lace machinery.

2529. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for an improved mode of preserving hops, and fitting them for storage and transportation,—being a communication.

2530. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in lamps,—being a communication.

2531. Daniel Augustus Leyshon, of Brockmoor, Brierly-hill, Staffordshire, for an improvement or improvements in coating certain forms or articles of iron, steel, or zinc.

2532. Henry Alexander Frederick Duckham, of Terthewey Lodge, Junction-road, Holloway, for improvements in gas-meters and regulators.

2533. William Sear, of Wolverton, for improvements in cartridges.

2534. Robert Garmany McCrum, of Milford, Armagh, Ireland, for improvements in machinery or apparatus for preparing cards for jacquard machines.

2535. Gavin Young, of Glasgow, for an improved hemming and binding gauge for sewing machines.

2536. William Eades and George Worstenholm, both of Birmingham, for certain improvements in screw stocks and dies for cutting or forming metal screws.

The above bear date October 17th.

2537. Archibald White, of Great Missenden, Buckinghamshire, for an apparatus for drying hay, corn, and roots, and other things.

2538. Thomas John Marshall, of Bishopsgate-street Without, for improvements in the manufacture of paper, and in machinery or apparatus for effecting the same.

2539. Alfred Bertrand Jacout, of Rheims, France, for improvements in water meters.

2541. Edward Habel, Jonas Holzwasser, and Edward Burns, all of Manchester, for certain improvements in steam-engines.

2542. Henry Williams, of Weston-

Super-Mare, for improvements in the manufacture of boots.

2543. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improvements in the construction of passenger carriages,—being a communication.

2544. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for improved machinery for crushing quartz and other substances,—being a communication.

2545. John Louis Jullion, of Tynemouth, for improvements in paper-making machinery,—being a communication.

2546. Maurice Wesolowski, of Cincinnati, U.S.A., for improvements in the obtaining of light, and in the apparatus employed therein,—being a communication.

2547. John Macintosh, of North Bank, Regent's-park, for improvements in apparatus for compressing air, and in raising and forcing water and other fluids.

2548. William Andrews, of Threadneedle-street, for improvements in insulators for telegraph wires.

2549. George Barclay Bruce and Andrew Stein, both of Great George-street, Westminster, for improvements in rail and tram-ways.

The above bear date October 18th.

2551. Joseph A. Munn, of New York, U.S.A., for a metallic thermometer, —being a communication.

2552. John Thompson, Edward Gerrard Fitton, and Frederick Alexander Fitton, of Manchester, for improvements in machinery used in boring, turning and cutting metals and other substances; part of which is applicable for driving other machinery.

2553. James Jack and David Rollo, both of Liverpool, for improvements in the construction of surface condensers, and feed water heaters, and in the combination of certain parts of steam-engines, especially adapted for marine purposes.

2554. James Marsden, of Turnmill-street, Clerkenwell, for an improved method of bleaching and whitening fibres and fabrics of various kinds.

2555. Charles Hoare, of Allington, Dorsetshire, for improvements in machinery for twisting and laying flax, hemp, and other fibrous materials.

2556. Thomas Moy, of Clifford's-inn, and Frederick Bayly Wardroper, of Warwick-square, Pimlico, for improvements in the construction of vessels for river navigation.

2557. Andrew George Hunter, of Newcastle-upon-Tyne, for improvements in treating sulphurets.

2558. Joseph Burch, of Crag, near Macclesfield, for improvements in the construction of boilers for generating steam and other heating purposes.

The above bear date October 19th.

2559. William Young, of Tavistock-place, for improvements in ship-building.

2560. James Ash, of Blackwall, for improvements in the construction of iron ships.

2561. William Jamieson, of Ashton-under-Lyne, and William Robinson and Cordingley Rowbottom, both of Glossop, for an improvement or improvements in apparatus for grinding or sharpening the cards used in carding fibrous materials.

2562. Weston Grimshaw, of Lytham, Lancashire, for improvements in machinery or apparatus for drying, mixing, and pulverising clay and other materials.

2563. Rigby Davies Smith and James Smith, both of London-wall, for improvements in the manufacture of leggings or knickerbockers.

2564. Paul Margetson, of New Weston-street, Bermondsey, for improvements in boots.

2565. Auguste Constantin Aimable Bertrand, of Cheshunt-terrace, Bermondsey, for improvements in the manufacture of matches and cigar-lights.

2566. Ebenezer William Hughes, of Parliament-street, for improvements in the construction of tents particularly adapted to military purposes, part of which invention is equally applicable to temporary buildings generally.

2567. William Clark, of Chancery-lane, for improvements in the manufacture of articles of jewellery, and

in apparatus for the same,—being a communication.

The above bear date October 20th.

2568. John Smith, of Manchester, and John Holt, of Farnworth, near Bolton-le-Moors, for improvements in machinery for preparing and spinning cotton and other fibrous materials.

2569. John Farmer and James Lansdell Fuggle, both of London, for improvements in the manufacture of scarfs, cravats, and similar articles.

2570. Charles Gourley Russell, of Manchester, for an improved method of, and apparatus for, facilitating the operation of certain kinds of printing from engraved plates, cylinders, lithographic stones, letter-press blocks, and other like surfaces.

2571. Richard Archibald Brooman, of Fleet-street, for improvements in apparatuses for evaporating and concentrating, specially applicable to the manufacture of sugar,—being a communication.

2573. Andrew Dietz, of New York, U.S.A., for an improved process or method for tanning skins, hides, &c., and converting them into leather.

2574. Joseph Wadsworth, of Marple, Cheshire, and James Wadsworth, of Salford, Lancashire, for improvements in gas burners, and improved modes of manufacturing the same.

2575. William Edward Gedge, of Wellington-street, for improvements in feeding steam-boilers,—being a communication.

2576. George William Hart, of Southsea, for improvements in the construction of vessels of war, and in propellors for the same.

2577. John Henry Johnson, of Lincoln's-inn-fields, for improvements in apparatus for measuring the flow of liquids; partly applicable to ordinary water cisterns,—being a communication.

The above bear date October 22nd.

2578. William Henry Tylor, of Warwick-lane, Newgate-street, for improvements in apparatus for heating and aerating saline or other liquids for baths, and in the salinometers employed in connection therewith; parts of which improvements are applicable to other purposes.

2579. William Henry Clark and John De la Mare, both of Jersey, for an improved lubricating composition to be used with other lubricators.

2580. Edwin Lewis, of Birmingham, for an improved apparatus for washing, cleaning, or separating particles of metal from other refuse matter.

2581. Edward Brown Wilson, of Parliament-street, for improvements in wheels for railway purposes.

2582. Robert Baynes, of Downshire-hill, Hampstead, for improvements in lawn mowing machines.

2583. John Webber, jun., of Trentham-terrace, Grove-road, Mile-end, for an improved mode of, and apparatus for, converting rope into oakum.

2584. Charles Lungley, of Deptford, for improvements in the construction of iron ships and other vessels, for the purpose of rendering them unsinkable and increasing their strength.

2585. George Beazley, of Highbury-park, for a new mode of preparing dyes produced from aniline.

2586. Thomas William Headlam, of Tottenham, for improvements in stuffing chairs, couches, mattresses, pillows, and other such like purposes, especially adapted also for stuffing cabin furniture, and the seats and backs of public and private vehicles.

The above bear date October 23rd.

2587. William Henry Walenn, of Talbot-road, Camden-road, Holloway, for improvements in magneto-electric machines, and in electro-magnetic engines.

2588. Guillaume Lacaire, of Créon, Gironde, France, for an improved penholder.

2589. James Kenyon, of Adlington, Lancashire, for certain improvements in looms for weaving.

2590. Edward Kenworthy Dutton, of Stretford, Lancashire, for certain improvements in machinery or apparatus for singeing textile goods or fabrics.

2591. David Allison and Jeremiah Kay, of Manchester, for improvements in window frames and sashes.

2592. James Taylor, of Staleybridge, and Horatio Nelson Gartside and John Heap Wood, both of Horest Mill, Saddleworth, Yorkshire, for im-

provements in self-acting mules for spinning and doubling.

2594. John McInnes, of Glasgow, for improvements in machinery, apparatus, or means for actuating or working railway brakes.

2595. William Eddington, jun., of Chelmsford, for improvements in machinery for draining, ploughing, and cultivating land.

2596. Thomas Garnett, of Low Moor, near Clitheroe, Lancashire, for certain improvements in looms for weaving.

2597. John Chisholm, George Chisholm, and Robert Thomas Kent, all of Mark-lane, for an improved method of obtaining compounds of nitrogen.

The above bear date October 24th.

2600. William Prosser, of Dorset-place, Dorset-square, and Henry John Standly, of Pall Mall East, for improvements in apparatus employed in the production of light.

2601. John Richards, of Tipton, for a new or improved break for arresting or stopping carriages or trucks on inclines, when, by the breaking of coupling links, or other accident, the said carriages or trucks are in danger of running down the said inclines.

2602. John Kay and John Hartley, both of Burnley, Lancashire, and Thomas Mallinson, of Manchester, for certain improvements in self-acting mules for spinning cotton and other fibrous substances.

2603. William Mann, of Barnsbury, for improvements in apparatuses for washing and condensing gas.

2604. Richard Archibald Brooman, of Fleet-street, for improvements in apparatuses for raising liquids,—being a communication.

2605. Henry Cook, of Cheetham-hill, Manchester, for an improvement in the manufacture of crinoline.

2606. William Colborne Cambridge, of Bristol, for improvements in the construction of harrows.

2607. William Hodson, of Kingston-upon-Hull, for improvements in fire-baskets or moveable grates and ovens.

The above bear date October 25th.

2608. Frederick Settle Barff, of Dublin, for improvements in the production of artificial stone; which improvements are also applicable to the preservation of stone, bricks, tiles, and other analogous substances or materials.

2609. Frederick Settle Barff, of Dublin, for an improved self-acting apparatus for extinguishing candles in lamps or otherwise.

2610. William Sharpe, of Swadlincote, Derbyshire, for improvements in latches and locks.

2611. Horace Boys, of the Downs, Northfleet, for improvements in preparing the bine and leaves of the hop plant.

2612. Thomas Cobley, of Meerholz, Hesse, Germany, for improvements in the manufacture of white lead (meaning carbonates of lead).

2613. Henry Stacey Aumonier and Charles John Wellard, both of St. John-street, Clerkenwell, for improvements in facilitating the division of sheets or pieces of paper, or other substances, into required forms, and in the means or apparatus employed therefor.

2615. Charles Frederick Clark, of Wolverhampton, for an improvement or improvements in enamelling or coating with glass certain kinds of metallic articles.

2616. Richard Archibald Brooman, of Fleet-street, for improvements in uniting water, gas, and other pipes and tubes,—being a communication.

2617. William Palmer, of Grange Mills, Bermondsey, for improvements in packing the pistons of cylinders.

2618. William Syrett, of Bury St. Edmunds, for improvements in steam-engines.

2619. Elijah Freeman Prentiss, of Philadelphia, U.S.A., for improvements in cars or carriages, to run on street railways or tramways.

The above bear date October 26th.

2620. Charles Hathaway, of Philadelphia, U.S.A., for improvements in the construction of street railways, and in the wheels to run thereon.

2621. Edward Spark Hall, of Cheapside, for an improvement in umbrellas and parasols.

2622. Henry Lawson, of Holcomb Brook, near Bury, Lancashire, for improvements in machinery for putting cop tubes on to the spindles of

mules for spinning, and in apparatus for supplying the cop tubes to the said machinery.

2623. Joseph Burch, of Crag, near Macclesfield, and Edward Booth, of Manchester, for certain improvements in extracting coloring matter from vegetable, animal, and other substances, and making decoctions and infusions therefrom.

2625. Walter Mabon, jun., and William Peel Gaulton, both of Manchester, for improvements in apparatus for heating the feed-water for steam-boilers, by the exhaust steam from high-pressure engines.

2626. Thomas Smedley, of Holywell, Flintshire, for improvements in the manufacture of metal rollers and cylinders used for calico printing and other purposes.

2627. Josiah Harris, of Newton Abbott, Devonshire, for moveable armour for protecting ships of war and batteries from the effects of shot and shell.

2628. William Hunt, of Tipton, for improvements in obtaining sulphur, or certain sulphur compounds, from certain other sulphur compounds, and in obtaining carbonic acid.

2629. William Mann, of the City Gas Works, Whitefriars, for a method of indicating, at a distance, the revolutions of shafts, spindles, and axles.

2630. Edmund Keogh Dwyer, of Pimlico, for improvements in machinery for doubling, creasing, and folding cloth.

2631. Frederick Henry Elliott, of the Strand, for an improved case for aneroid barometers for marine purposes.

2633. William Clark, of Chancery-lane, for improvements in corsets and their fastenings, which are also applicable to other articles of dress,—being a communication.

2634. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improved apparatus for milking cows,—being a communication.

The above bear date October 27th.

2635. Amherst Hawker Renton, of Cambridge-street, Eccleston-square, Pimlico, for improvements in apparatus employed in the production of light.

2636. Robert Blacklidge, of Bolton-le-Moors, for improvements in the preparation of materials for sizing, dressing, or finishing warps, yarns, textile fabrics, or paper.

2637. Nehemiah Brough and George Thomas Kilby, both of Birmingham, for new or improved fastenings for articles of dress, and for fastening belts and bands generally.

2638. Thomas Wilson, of Birmingham, for improvements in moveable spanners or screw-wrenches.

2639. John Adams Knight, of Symond's-inn, Chancery-lane, for a new system of photographic or daguerrean apparatus or objective, to be called 'Korn's polyograph,'—being a communication.

2641. Frederick Henry Elliott and Charles Alfred Elliott, both of the Strand, for an instrument for indicating the approach of vessels to shoals, rocks, and land.

2642. Edward Harrison, William Bradbury, James Buckley, and Dan Garside, all of Oldham, for a certain compound, or certain compounds, to be used as a substitute for gunpowder.

2643. Thomas Greenwood and Jacob Dockray, both of Leeds, for improvements in machinery for carding, opening, and straightening tow and other fibrous substances.

2645. William Edward Newton, of the Office for Patents, 66 Chancery-lane, for improvements in looms,—being a communication.

2647. Charles Crockford, of Holywell, Flintshire, for improvements in the manufacture of spelter from the sulphuret of zinc.

2649. Michael Henry, of Fleet-street, for an improved method of manufacturing railway wheel tyres and other articles of steel,—being a communication.

The above bear date October 29th.

2650. Isaac Dreyfus, of Paris, for improvements in rolling iron, and in machinery employed therein.

2652. John Beck, of Broadwall, Christchurch, Surrey, for improvements in stop valves for water, steam, or other fluids.

2653. David Selkirk Miller, of Glasgow,

for improvements in weaving, and in the apparatus used for that purpose.

2655. Alfred Vincent Newton, of the Office for Patents, 66 Chancery-lane, for an improved mode of, and apparatus for, desiccating wet or moist substances,—being a communication.

2657. James McLintock Henderson, of Renfrew, for improvements in marine steam-engines.

The above bear date October 30th.

2659. Antoine Léopold Chéradame and Jean Baptiste Achille Lambert, both of Paris, for a life-preserver.

2662. Louis Martin, of Tenison-street, York-road, Lambeth, and Oliver Penfold, of Blackmoor-street, Drury-lane, for improvements in the manufacture of candles.

2663. John Charles Pearce, of the Bowling Iron Works, near Bradford, Yorkshire, for improvements in steam-engines and boilers.

2664. George Davies, of Serle-street, for improvements in boxes for railway carriage axles, and other shafts, —being a communication.

2665. George Davies, of Serle-street, Lincoln's-inn, for improvements in the manufacture of boots, shoes, and other coverings for the feet, and in apparatus connected with such manufacture,—being a communication.

2666. James Anderson, of Belfast, for improvements in the manufacture of felt, and in the mode of applying the same to railways and to other uses.

The above bear date October 31st.

2667. William Reynolds and George Alfred Samson, both of Edmonton, for improvements in the manufacture of boots and shoes.

2668. David Joy, of Manchester, for improvements in the valves of steam hammers; which are also applicable to other purposes.

The above bear date November 1st.

NEW PATENTS SEALED.

1860.

1024. J. and B. Stafford.
1033. T. A. Claeys.
1042. J. G. West.
1051. G. F. Train.
1052. William Buckwell.
1053. J. H. Johnson.
1056. W. J. Harvey.
1058. J. G. and J. White.
1059. Léopold d'Aubréville.
1061. Peter Thorn.
1063. John Nichols.
1064. James Bullough.
1065. Franz Thonet.
1067. H. S. Rosser.
1075. Thomas Molineux.
1076. Joseph Green.
1079. W. H. Samson.
1085. Georges Masure.
1091. E. T. Hughes.
1093. J. H. Bennett.
1094. Alfred Upward.
1098. George Bower.
1107. Mathieu Bonnor.
1109. Thomas Silver.
1111. J. Brickhill and J. Noble.
1114. Michael Henry.
1115. George Davies.
1116. Henry Reid.
1118. Timothy Railton.
1122. Edwin Hardon.
1124. Joseph Grimond.
1127. A. Tweedale, J. Tweedale, and S. Taylor.
1128. J. D. Dougall.
1132. J. A. Eisenstuck.
1136. William M. Donald.
1138. Walter Evans.
1142. Henry Kemp.
1144. Ellis Butterworth.
1145. J. B. J. De Buyer.
1146. James Reid.
1148. J. M. Fisher.
1151. W. B. Johnson.
1154. H. Wildsmith, J. Carter, and J. J. Carter.
1157. Alexander Wilson.
1162. George Holcroft.
1163. Samuel Ridge.
1165. R. A. Brooman.
1166. Andrew Robertson.
1167. T. H. Morell and H. Charnley.
1169. W. E. Newton.
1170. J. Owen and G. Veitch.
1171. William Clark.
1175. William Basford.
1176. Robert Young.
1178. J. Chatterton and W. Smith.
1179. S. C. Salisbury.
1180. A. Pullan, T. Cresswell, and R. Longstaff.
1181. H. L. Lilley.
1185. W. E. Newton.

1193. G. H. Barth.
1195. J. Higgins and T. S. Whitworth.
1197. S. C. Salisbury.
1198. Julien Denis.
1200. R. J. Jordan.
1201. D. Sant Agata.
1203. John Grant.
1208. W. E. Newton.
1209. C. M. Guillemin.
1210. William Krutzsch.
1214. M. A. F. Mennons.
1216. Joseph Nicholson.
1218. A. Robertson and A. Ritchie.
1219. S. C. Salisbury.
1220. James Cole.
1221. A. B. Ibbotson.
1225. J. D. Dunnicliff and S. Bates.
1226. William Geeves.
1228. H. N. Nissen.
1229. S. and A. Fielden.
1230. James Ferguson.
1232. A. R. Turner.
1234. Samuel Davey.
1235. Josiah Lees.
1237. W. E. Newton.
1238. W. E. Newton.
1239. John Longmaid.
1240. C. Binks and J. Macqueen.
1241. C. J. De Meyer.
1242. James Copcutt.
1243. Thomas Blakeley.
1245. T. W. Teulon.
1246. William Barker.
1247. James Craig.
1248. S. R. Samuels.
1253. George Moulton.
1256. Samuel Hood.
1257. James Hinks.
1265. J. H. Johnson.
1268. Michael Henry.
1270. Thomas Cope.
1272. Michael Kavanagh.
1273. P. E. Chevalier.
1274. George Bartholomew.
1280. Denis Mulkay.
1288. William Baker.
1289. W. E. Newton.
1292. Ermelinde De Block Stevens.
1295. John Macintosh.
1296. A. Hubart and V. Cantillon.
1299. George Wallis.
1300. G. De Laire and C. Girard.
1316. Rev. H. Moule and J. Bannehr.
1321. J. Dugdale, jun., and E. Dugdale.
1323. W. S. Nosworthy.
1324. Floride Heindryckx.
1331. E. A. L. D'Argy.
1334. Charles Greenway.
1336. W. E. Newton.
1340. A. V. Newton.
1347. W. H. Harfield.
1348. Charles Clay.
1354. A. G. Hunter.
1360. W. E. Newton.
1365. John Juckes.
1374. George Fletcher.
1379. E. and R. Lavender.
1387. Charles Stevens.
1388. Charles Stevens.
1390. Joseph Jewsbury.
1394. W. Mc Intyre Cranston.
1417. W. E. Newton.
1448. William Spence.
1454. Michael Henry.
1455. Isaac Whitesmith.
1478. Hamlet Nicholson.
1482. A. B. Childs.
1496. E. B. Webb.
1503. John Smith.
1528. David Dawson.
1556. W. E. Newton.
1571. William Clark.
1662. George Ager.
1673. John Davis.
1699. J. Pile and J. R. Smyth.
1722. W. E. Newton.
1774. A. R. Le Mire Normandy.
1879. James Higgin.
1957. A. V. Newton.
1959. A. V. Newton.
1960. A. V. Newton.
1961. A. V. Newton.
1995. George Nimmo.
1996. Robert Read.
2000. Daniel Foxwell.
2011. John Neal.
2016. Moritz Jacoby.
2022. F. R. Grumel.
2032. William Spence.
2042. JamesFleming, jun.
2051. J. T. and G. Wilkes.
2053. A. V. Newton.
2061. John Arrowsmith.
2089. Sir P. Fairbairn.
2119. John and Joseph Fisher.
2121. W. Forgie and T. Finn.
2125. Charles Mason.
2131. J. Hughes, W. Williams, and G. Leyshon.
2159. A. D. Lacy & W. C. Homersham.
2167. P. E. Aubertin.
2209. Nathan Thompson.
2253. James Hansor.
2261. W. E. Newton.

*** *For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.*

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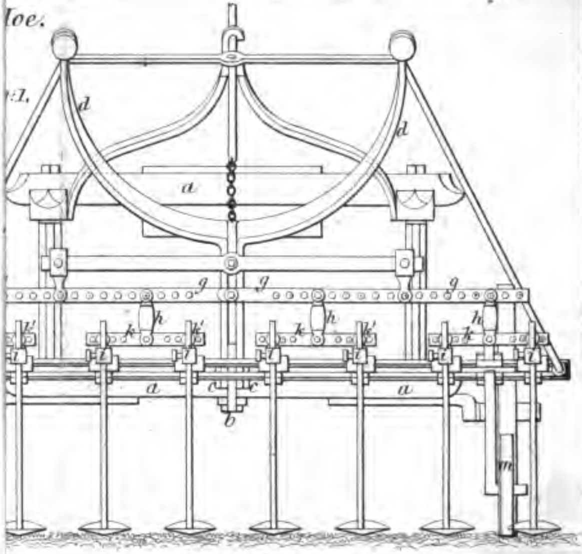
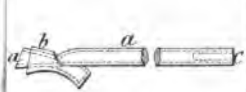
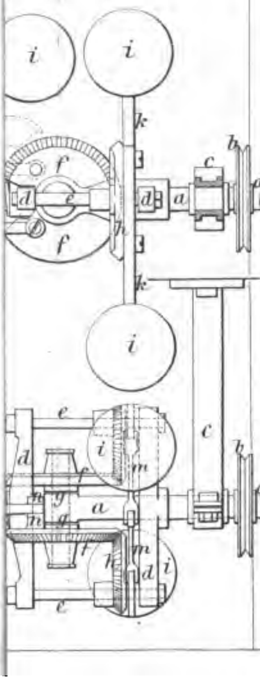


Wilson's cleaning guns.





Rae's rivetting.